FINAL

Confirmation Sampling and Analysis Report for the BX Service Station, Facility 736, Site ST-29



Patrick Air Force Base **Florida**

Prepared For

Air Force Center for Environmental Excellence **Brooks Air Force Base, Texas**

and

42 CES/CEV **Patrick Air Force Base Florida**

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Prepared for:

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45 CES/CEV Patrick AFB, Florida

Contract F41624-92-8036, Delivery Order 17

March 1999

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ACRONYMS AND ABBREVIATIONS

45 CES/CEV 45th Civil Engineering Squadron/Environmental Flight

AFB Air Force Base

AFCEE Air Force Center for Environmental Excellence

AST aboveground storage tank bgs below ground surface

BTEX benzene, toluene, ethylbenzene, and xylenes

BX Base Exchange

ES Engineering-Science, Inc.

ESE Environmental Science & Engineering, Inc.

FAC Florida Administrative Code

FDEP Florida Department of Environmental Protection

HP horsepower

HVW horizontal vent well

internal combustion engine **ICE** LIF laser-induced fluorescence light nonaqueous-phase liquid LNAPL micrograms per kilogram μg/kg micrograms per liter $\mu g/L$ milligrams per kilogram mg/kg milligrams per liter mg/L motor vehicle gasoline **MOGAS** monitoring point MP **MTBE** methyl tert-butyl ether no further action **NFA**

OB&G O'Brien and Gene Engineers, Inc.
PAH polynuclear aromatic hydrocarbon
PAMP Petroleum Action Management Plan
Parsons ES Parsons Engineering Science, Inc.

PID photoionization detector

ppmv parts per million, volume per volume

QA quality assurance QC quality control RAP remedial action plan

SAP Sampling and Analysis Plan

SVE soil vapor extraction

TPH total petroleum hydrocarbons

TRPH total recoverable petroleum hydrocarbons

TVH total volatile hydrocarbons

USCS Unified Soil Classification System
USEPA US Environmental Protection Agency

UST underground storage tank VOC volatile organic compound

INTRODUCTION

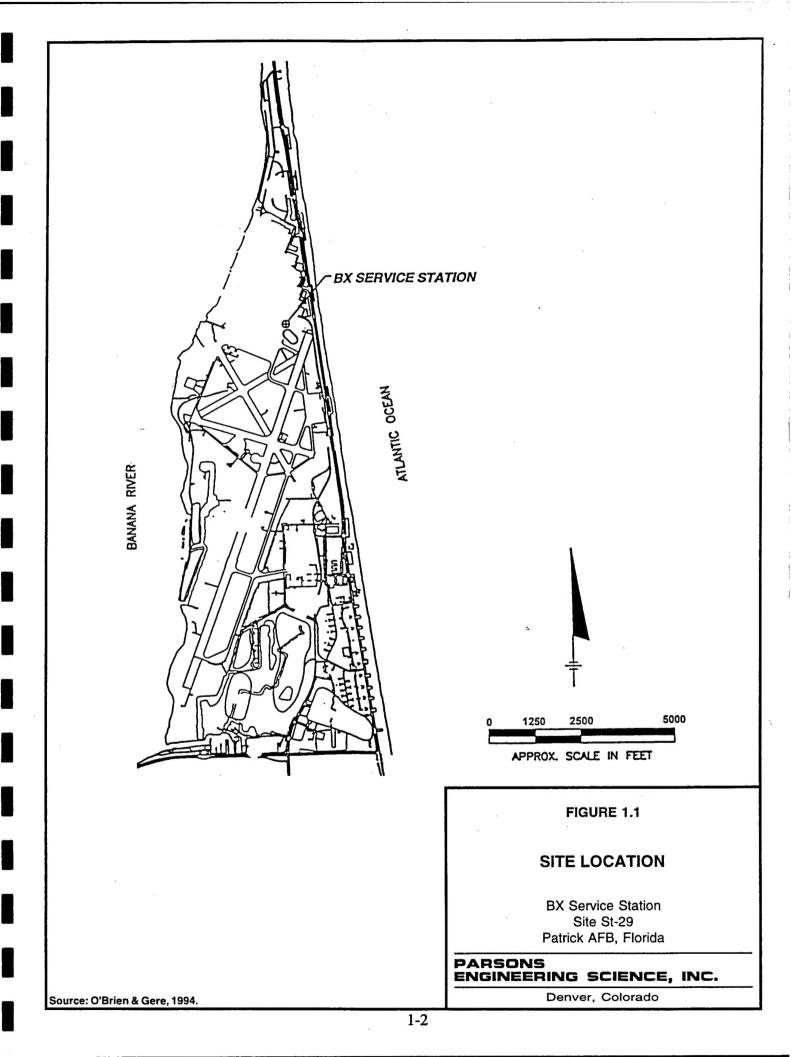
1.1 PURPOSE

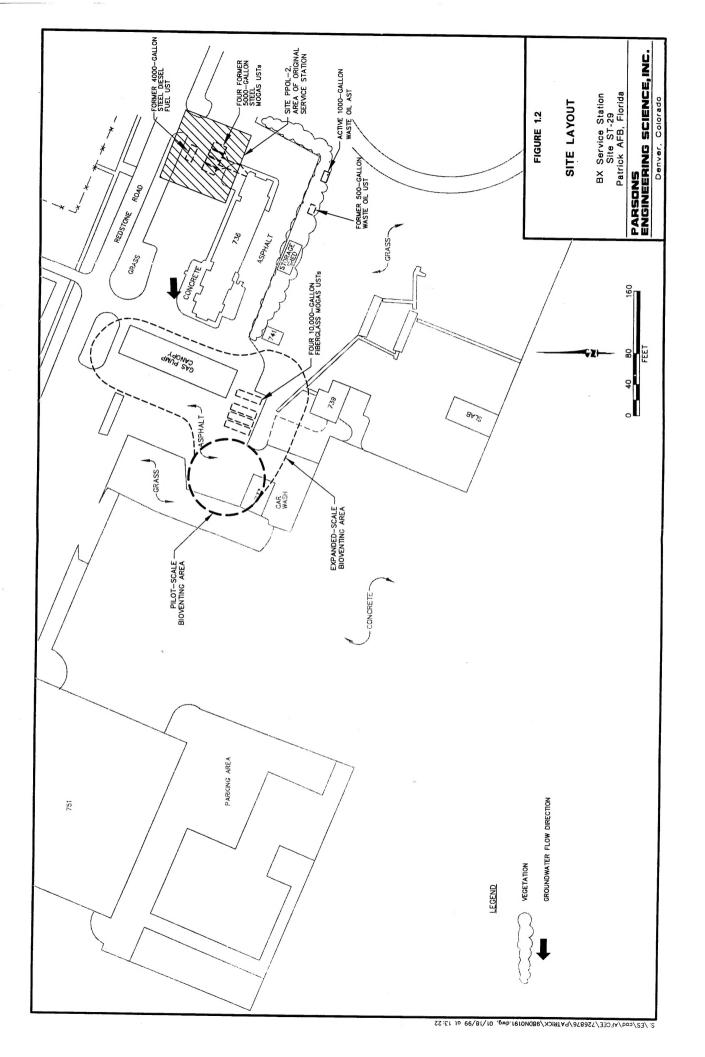
This confirmation sampling and analysis report for the Base Exchange (BX) Service Station, Facility 736, Site ST-29, at Patrick Air Force Base (AFB), Florida has been prepared by Parsons Engineering Science, Inc. (Parsons ES) for submittal to the Florida Department of Environmental Protection (FDEP); the US Air Force Center for Environmental Excellence (AFCEE), Brooks AFB, Texas; and 45th Civil Engineering Squadron, Environmental Flight (45 CES/CEV), Patrick AFB, Florida. This report has been prepared as part of the AFCEE Extended Bioventing Project (Contract F41624-92-8036, Delivery Order 17). The purpose of this report is to provide the results of confirmation soil sampling performed at the site in July 1998, which document the effectiveness of soil remediation at the BX Service Station and verify that the vadose zone soils at the site generally meet FDEP (1997) conditions for closure. FDEP has already approved no further action (NFA) for vadose zone soils at Site ST-29; the site is currently under "groundwater monitoring only" status (Parsons ES, 1998a). This project addresses only the vadose zone soils at the BX Service Station. There is a dissolved contaminant plume in groundwater at the BX Service station site that is the focus of a separate effort (the AFCEE Intrinsic Remediation Project, Parsons ES, 1995b).

1.2 SITE AND PROJECT BACKGROUND

1.2.1 Site Description and Background

Patrick AFB lies on a long barrier island situated off Florida's east coast, in Brevard County. Patrick AFB is bounded on the east by the Atlantic Ocean and on the west by the Banana River. The City of Cocoa Beach is located immediately north of the Base, and Satellite Beach is directly south. The BX Service Station is located in the north-central section of Patrick AFB (Figure 1.1). A layout of the site is presented on Figure 1.2. The BX Service Station is located on a level ground surface covered primarily with asphalt and concrete pavement. Soils at this site consist of predominantly unconsolidated, poorly to moderately well-sorted, fine- to coarse-grained quartz sand with up to 40-percent shell fragments. This marine sand deposit extends to approximately 25 feet below ground surface (bgs). Shallow groundwater at the site is unconfined and typically encountered in the sand at approximately 4 to 6 feet bgs. Historical groundwater elevation data indicate that groundwater flow at the site is generally to the west (Environmental Science & Engineering, Inc. [ESE], 1991; Parsons ES, 1995a).





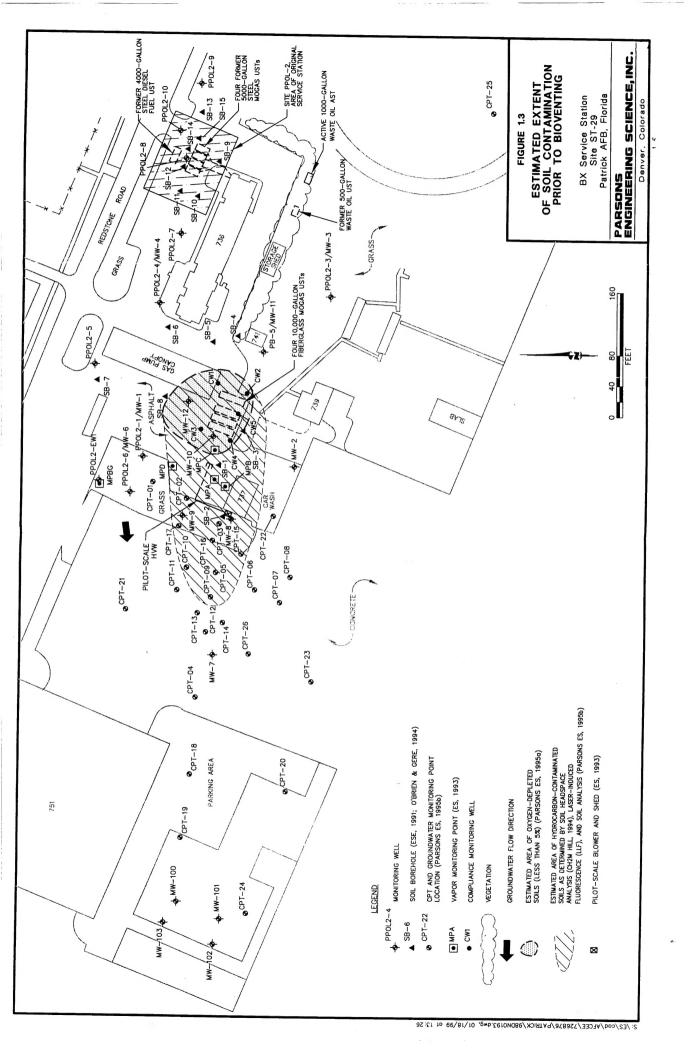
The original service station area is located to the northeast of Building 736, as shown on Figure 1.2. The original service station (Site PPOL-2) consisted of four former 5,000-gallon steel underground storage tanks (USTs) that contained motor vehicle gasoline (MOGAS), a former 4,000-gallon steel UST that contained diesel fuel, and two former dispenser islands and associated piping. The former dispenser islands were located above the USTs. During a major renovation in 1973, the dispenser islands were removed. The original USTs were abandoned in place, and the original service station area was paved with asphaltic concrete.

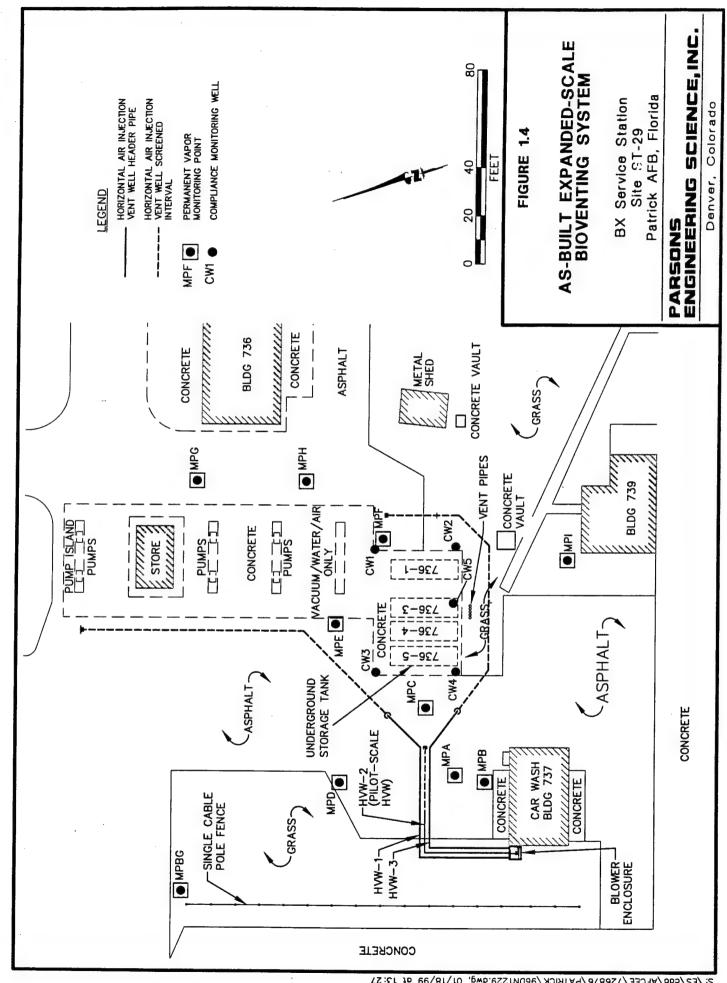
New fueling facilities consisting of dispenser islands, five 10,000-gallon fiberglass USTs for MOGAS, and associated piping were installed in their current locations west and southwest of Building 736 (Figure 1.2). In 1985, a leak was detected in a fiberglass fuel line, and in 1986, one of the 10,000-gallon fiberglass USTs was removed due to leakage. It is estimated that approximately 700 gallons of MOGAS was released into the subsurface as a result of the fuel line and UST leaks (ESE, 1991). In February 1992, a 500-gallon UST southeast of Building 736 was removed and replaced with a 1,000-gallon waste oil aboveground storage tank (AST). In 1993, the five abandoned USTs located northeast of Building 736 were excavated and removed along with some excessively contaminated soils (O'Brien & Gere Engineers, Inc. [OB&G], 1995).

Site investigations identified a larger area of contaminated soil west and southwest of Building 736, and the contaminants included benzene, toluene, ethylbenzene, and xylenes (BTEX), total recoverable petroleum hydrocarbons (TRPH), and other organic compounds in soils and groundwater. Petroleum-contaminated soil was estimated to extend approximately 220 feet downgradient from the source area. Figure 1.3 shows the estimated extent of petroleum-contaminated soil at the site prior to remediation activities. Much of the petroleum contamination was present in saturated soils. More complete summaries of previous site investigations are included in the sampling and analysis plan (SAP) (Appendix A).

1.2.2 Project Background

In 1992, the BX Service Station was selected as a pilot test site for the AFCEE Bioventing Initiative program. This program included conducting more than 135 in situ bioventing pilot tests at 48 military installations nationwide. These tests were designed to collect data on the effectiveness of bioventing for the remediation of soil contaminated with fuel hydrocarbons (e.g., JP-4 jet fuel, diesel fuel, gasoline, heating oil, and other fuels and petroleum-based solvents). A pilot-scale remediation system consisting of one horizontal vent well (HVW), five soil gas monitoring points (MPA, MPB, MPC, MPD, MPBG), and a 1-horsepower (HP) blower was installed at the BX Service Station in the area of the active USTs in March 1993 (Figure 1.4). An initial air-injection bioventing pilot test also was performed at the site in March 1993. Results of the pilot test demonstrated that bioventing was an effective technology for remediation of the site, but also showed that air-injection bioventing could be hazardous due to high levels of total volatile hydrocarbons (TVH) present in soil gas. Air injection into the HVW could possibly drive hydrocarbon vapors into ambient air. To reduce the initial high levels of TVH in soil gas, a soil vapor extraction (SVE) pilot test





using an internal combustion engine (ICE) to draw and combust soil gas from the HVW was performed from October 1993 to January 1994. A 96-percent reduction of TVH concentrations in extracted soil gas was achieved during the 3-month SVE pilot test (AFCEE, 1994). The pilot-scale air-injection bioventing system was started immediately after SVE system shutdown, and was operated for 9 months (from January through November 1994), resulting in one complete year of pilot-scale system operation. Results of the 1-year pilot-scale test demonstrated that SVE and air injection bioventing had effectively treated petroleum-contaminated soils in the area influenced by the pilot-scale system. Patrick AFB personnel continued to operate the pilot-scale bioventing system following the 1-year pilot test.

In September 1994, AFCEE provided funding for expansion of the bioventing system, 1 year of expanded-scale system operation and monitoring, and confirmation soil sampling at the BX Service Station site under the AFCEE Extended Bioventing Project (Contract F41624-92-8036, Delivery Order 17). In July 1995, the pilot-scale bioventing system was expanded to include two additional HVWs (HVW-1 and HVW-3; the pilot-scale HVW was designated HVW-2), and five additional MPs (MPE, MPF, MPG, MPH, and MPI) (Figure 1.4). Expanded-scale bioventing system operation began in July 1995. In November 1996, soil gas sampling and respiration testing were performed following approximately 15 months of expanded-scale bioventing system operation. Results indicated that BTEX concentrations in vadose zone soils had been significantly reduced, but that elevated TVH and depleted oxygen levels, indicative of remaining fuel contamination, were observed at MPF (Parsons ES, 1997). expanded-scale bioventing system was operated for approximately 20 additional months prior to confirmation soil sampling activities to continue to remediate soils near MPF. As of July 1998, soils in the vicinity of the original pilot-scale system have benefited from 4.75 years of soil venting, and soils influenced by the expanded-scale bioventing system have received 3 years of treatment.

This report presents the results of the confirmation soil sampling performed by Parsons ES in July 1998 at the BX Service Station. In preparation for the confirmation soil sampling, a site-specific SAP was prepared by Parsons ES (1998b). A copy of the SAP is provided as Appendix A. Following FDEP, AFCEE, and Patrick AFB approval of the SAP, confirmation soil sampling was conducted at the BX Service Station on 27 and 28 July 1998. Confirmation soil sampling activities consisted of advancing 15 boreholes to the groundwater surface (encountered at approximately 3.5 to 4 feet bgs), and analyzing selected soil samples collected from the top of the capillary fringe for hydrocarbon constituents to determine contaminant concentrations in site soils following treatment. A total of 17 soil samples from the 15 boreholes were submitted for laboratory analysis.

1.3 SUMMARY OF CONFIRMATION SAMPLING RESULTS

Results of the soil analyses indicate that remediation activities at the site have successfully reduced all target compounds, with the exception of TRPH at one location, to levels below FDEP (1997) closure standards in vadose zone soils. Xylenes were detected in six soil samples at concentrations not exceeding 6 micrograms per kilogram ($\mu g/kg$). Toluene was detected in three soil samples at estimated concentrations not

exceeding 1.3 μ g/kg. Ethylbenzene was detected in two samples at concentrations not exceeding 18.5 μ g/kg. No other volatile organic compounds (VOCs) were detected in samples from the site. Five polynuclear aromatic hydrocarbons (PAHs) were detected in three soil samples at concentrations not exceeding 18 μ g/kg. Residual TRPH were not detected in 16 of the 17 soil samples. TRPH were detected at 600 milligrams per kilogram (mg/kg) in the primary soil sample collected 3 feet bgs near MPF.

1.4 REPORT ORGANIZATION

This site confirmation sampling and analysis report consists of five sections, including this introduction, and two appendices. Section 2 includes a description of the confirmation soil sampling and analysis activities conducted at the site. Section 3 summarizes confirmation sampling analytical results and compares results to FDEP closure standards. Section 4 presents conclusions and recommendations; references used in preparation of this report are provided in Section 5.

Appendix A presents a copy of the confirmation SAP for the BX Service Station, which includes a detailed summary of previous site investigations. Appendix B presents laboratory analytical data for site environmental and quality assurance/quality control (QA/QC) samples, and chain-of-custody forms.

CONFIRMATION SOIL SAMPLING AND ANALYSIS ACTIVITIES

This section summarizes confirmation soil sampling activities, including sampling locations and depths, sampling procedures, analytical methods, and QA/QC procedures followed. These procedures are described in more detail in the confirmation SAP for the BX Service Station (see Appendix A). The SAP was implemented by qualified Parsons ES scientists trained in conducting soil sampling, records documentation, and chain-of-custody procedures. Environmental sample analyses were performed by Specialized Assays Inc. (SAI) of Nashville, Tennessee, a State of Florida-certified analytical laboratory.

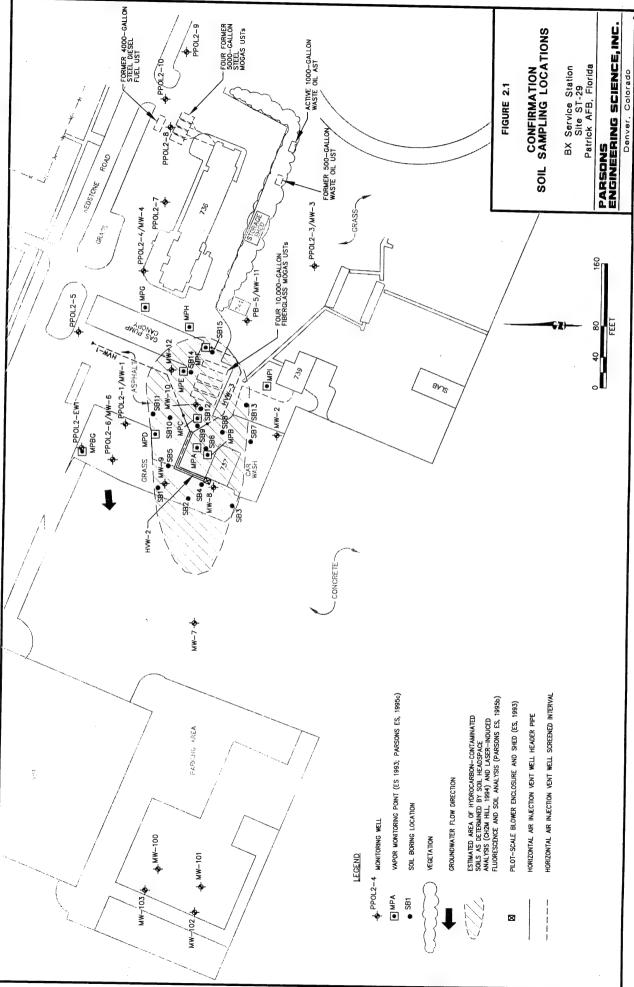
2.1 BOREHOLE LOCATIONS AND SAMPLING DEPTHS

Confirmatory soil sampling was conducted at the site on 27 and 28 July 1998. Fifteen boreholes (SB1 through SB15) were advanced at the site, and 17 soil samples (15 primary samples, and replicate samples at SB1 and SB15) were collected for laboratory analysis. The boreholes were located in the vicinity of the former fiberglass MOGAS UST, and in the area previously shown to contain elevated hydrocarbon contamination (Figure 1.3). Figure 2.1 shows the locations of the confirmatory soil sampling boreholes. Soil boreholes were advanced to the groundwater surface using a hand auger. The groundwater surface was encountered at depths between 3.5 and 4 feet bgs, which is much shallower than it had been encountered during previous site activities. The groundwater table at this site is typically encountered at depths between 4 and 6 feet bgs. The relatively high groundwater table conditions during the July 1998 sampling event prevented the collection of unsaturated soil samples from depths below 3.2 feet bgs. Soil samples were obtained from the top of the capillary fringe at each borehole by collecting the required volume of soil directly from the hand-auger bucket. Soil samples were collected at each location at depths between 2.7 and 3.2 feet bgs.

2.2 DRILLING, SAMPLING, AND EQUIPMENT DECONTAMINATION

Soil types were classified according to the Unified Soil Classification System and described in accordance with the standard Parsons ES soil description format. All soil samples were visually examined, and sample headspaces were field screened for VOCs using a Photovac Microtip photoionization detector (PID). The data obtained from the logging and screening were recorded in the field notebook.

Based on field screening results, one sample from each boring (SB1 through SB15) was selected and submitted for laboratory analysis using laboratory-prepared containers. Replicate samples also were collected from boreholes SB1 and SB15.



2-2

Samples selected for laboratory analysis were labeled with the site name and borehole number, sample depth, date of collection, requested analyses, project name, and other pertinent data. The sample containers were sealed in plastic bags and immediately placed in an insulated cooler containing ice. The soil samples were maintained in a chilled condition until delivery to the analytical laboratory. Chain-of-custody records were prepared in the field and accompanied the samples to SAI.

Augers and other downhole equipment were cleaned before use and between boreholes to prevent cross-contamination. Between sampling events, the hand-auger bucket was cleaned with Alconox® detergent, followed by successive potable and distilled water rinses. Drill cuttings were returned to their respective boreholes following drilling and sampling, and boreholes were abandoned using bentonite to fill the boreholes to the ground surface, as necessary. Boreholes drilled through asphalt were repaired at the surface using asphalt cold-patch.

A total of 17 soil samples (one sample from 3 feet bgs from SB1 through SB15, and replicate samples from SB1 and SB15) were collected and submitted for laboratory analysis of BTEX and other VOCs by US Environmental Protection Agency (USEPA) Method SW8021B, PAHs using USEPA Method SW8310, and TRPH using State of Florida Method FL-PRO. A trip blank and an equipment rinseate blank were also submitted for laboratory analysis of BTEX and other VOCs by USEPA Method SW8021B. All samples were analyzed by SAI, a State of Florida-certified analytical laboratory.

2.3 FIELD AND LABORATORY DATA QUALITY ASSURANCE/QUALITY CONTROL

Samples were collected, preserved, transported, and analyzed in such a manner that the sampling results would provide a reliable representation of the soil quality at the site. To meet this requirement, the procedures described in Section 4 of the SAP (Appendix A) were followed during sample collection, handling, and analysis. Two field replicates were collected as QA samples. An equipment rinseate and a trip blank were also submitted to the analytical laboratory. In addition, laboratory QC samples were prepared and analyzed.

CONFIRMATION SAMPLING RESULTS

This section summarizes the analytical results from confirmation soil sampling activities. Soil cleanup criteria proposed in the SAP also are reviewed.

3.1 LABORATORY ANALYTICAL RESULTS

Soil analytical results are summarized in Table 3.1, and data from SAI are provided in Appendix B. Seventeen soil samples from 15 borehole locations were analyzed by SAI for VOCs by USEPA Method SW8021B, PAHs by USEPA Method SW8310, and TRPH using the State of Florida Method FL-PRO. All soil samples were collected from the top of the capillary fringe at depths between 2.7 to 3.2 feet bgs.

The results of the SW8021B analyses for VOCs indicated the presence of m- and p-xylenes in six samples (SB9, SB10, SB11, SB14, SB15, and the replicate sample collected at SB15) at concentrations ranging from an estimated value of 1.3J μ g/kg to 6 μ g/kg. o-Xylene was detected in three samples (SB9, SB15, and the replicate sample collected at SB15) at concentrations ranging from an estimated value of 1.1J μ g/kg to 5.1 μ g/kg. Toluene was detected in three samples (SB9, SB15, and the replicate sample collected at SB15) at estimated concentrations ranging from 1.1J to 1.3J μ g/kg. Ethylbenzene was detected in two samples (SB15, and the replicate sample collected at SB15) at concentrations of 18.5 and 18.2 μ g/kg, respectively. There were no detections of benzene, dichlorobenzenes, chlorobenzene, or methyl-tertiary-butyl-ether (MTBE) in any of the soil samples.

Low levels of PAHs were also detected in the samples collected at SB12, SB15, and the replicate sample collected at SB15. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene, were detected at estimated concentrations ranging from 4J to 18J μ g/kg. No other PAHs were detected.

TRPH were detected at 600 mg/kg in the primary sample collected at SB15. TRPH were not detected in the replicate soil sample from this location nor in any of the other samples; the laboratory reporting limits for these samples ranged from 10.2 to 11.1 mg/kg.

In previous soil sampling performed during bioventing system installation and expansion, maximum detected concentrations of each constituent included benzene at 470 μ g/kg (from MPF at 3.5 feet bgs during expanded-scale bioventing system installation in July 1995), toluene at 54,000 μ g/kg (from HVW-2 at 4.5 feet bgs during

RESULTS OF CONFIRMATION SOIL SAMPLING AND COMPARISON TO CLOSURE CRITERIA TABLE 3.1

PATRICK AIR FORCE BASE, FLORIDA BX SERVICE STATION, SITE ST-29

		FDEP Tai	Target Cleanup Levels ^a									
		Direct Expo	xposure	Soil		Replicate						
Analytes		I	Ш	Leachability ^{c/}	SB1-3	SB1-3	SB2-3	SB3-3	SB4-3	SB5-3	SB6-3	SB7-3
Method SW8021	Units											
1,2-Dichlorobenzene	$\mu g/kg^{d\prime}$	NA ^{e'}	NA	NA	4.2 U"	22.2 U	20.8 U	4.1 U	4.2 U	4.3 U	4.3 U	4.2 U
1,3-Dichlorobenzene		NA	N A	NA	4.2 U	22.2 U	20.8 U	4.1 U	4.2 U	4.3 U	4.3 U	4.2 U
1,4-Dichlorobenzene		VA	NA	NA	3.1 U	16.7 U	15.6 U	3.1 U	3.1 U	3.2 U	3.2 U	3.1 U
Benzene		1,100	1,500	7	1 U	5.6 U	5.2 U	1 U	1 U	1.1 U	1.1 U	1 U
Chlorobenzene		ΝA	NA	NA	2.1 U	11.1 U	10.4 U	2.1 U	2.1 U	2.1 U	2.2 U	2.1 U
Ethylbenzene		240,000	240,000	400	2.1 U	11.1 U	10.4 U	2.1 U	2.1 U	2.1 U	2.2 U	2.1 U
m,p-Xylenes		NA	NA	NA	2.1 U	11.1 U	10.4 U	2.1 U	2.1 U	2.1 U	2.2 U	2.1 U
o-Xylene		NA A	NA	NA	2.1 U	11.1 U	10.4 U	2.1 U	2.1 U	2.1 U	2.2 U	2.1 U
Total Xylenes		290,000	290,000	300	/8	1	ł	;	1	1	}	1
MTBE		350	6,100	200	2.1 U	11.1 U	10.4 U	2.1 U	2.1 U	2.1 U	2.2 U	2.1 U
Toluene		300,000	2,000,000	400	2.1 U	11.1 U	10.4 U	2.1 U	2.1 U	2.1 U	2.2 U	2.1 U
Method SW8310												
Acenapthene	μg/kg	2,300,000	22,000,000	4,000	1250 U	1330 U	1250 U	1240 U.	1250 U	1280 U	1290 U	1250 U
Acenapthylene		1,100,000	11,000,000	22,000	1600 U	1710 U	1600 U	1590 U	1600 U	1640 U	1660 U	1600 U
Anthracene		19,000,000	290,000,000	2,000,000	458 U	489 U	458 U	454 U	458 U	468 U	473 U	458 U
Benzo(a)anthracene		1,400	5,100	2,900	9.4 U	10 U	9.4 U	9.3 U	9.4 U	0.6 U	9.7 U	9.4 U
Benzo(a)pyrene		100	200	7,800	16 U	17 U	16 U	15 U	16 U	16 U	16 U	16 U
Benzo(b)fluoranthene		1,400	2,000	6,800	12 U	13 U	12 U	12 U	12 U	13 U.	13 U	12 U
Benzo(g,h,i)perylene		2,300,000	45,000,000	13,000,000	52 U	26 U	52 U	52 U	52.U	53 U	54 U	52 U
Benzo(k)fluoranthene		15,000	52,000	25,000	11 U	12 U	11 U	11 U	11 U	12 U	12 U	11 U
Chrysene		140,000	490,000	80,000	104 U	111 U	104 U	103 U	104 U	106 U	108 U	104 U
Dibenzo(a,h)anthracene		100	200	14,000	21 U	22 U	21 U	21 U	21 U	21 U	22 U	21 U
Fluoranthene		2,800,000	45,000,000	550,000	146 U	156 U	146 U	144 U	146 U	149 U	151 U	146 U
Fluorene		2,100,000	24,000,000	87,000	146 U	156 U	146 U	144 U	146 U	149 U	151 U	146 U
Indeno(1,2,3-cd)pyrene		1,500	5,200	28,000	31 U	33 U	31 U	31 U	31 U	32 U	32 U	31 U
Naphthalene		1,000,000	8,600,000	1,000	1250 U	1330 U	1250 U	1240 U	1250 U	1280 U	1290 U	1250 U
Phenanthrene		1,900,000	29,000,000	120,000	438 U	467 U	438 U	433 U	438 U	447 U	452 U	438 U
Pyrene		2,200,000	40,000,000	570,000	188 U	200 U	188 U	186 U	188 U	191 U	194 U	188 U
Method FLA PRO												
Total Recoverable	mg/kg ^{h/}	350	2,500	340	10.4 U	11.1 U	10.4 U	10.3 U	10.4 U	10.6 U	10.8 U	10.4 U
Petroleum Hydrocarbons												
a/ FDEP, 1997.												

at 1997.

b) Direct Exposure I and II are for No Further Action Without or With Conditions, respectively.

022/726876/PATRICK/4 xls

c/ Based on Table V (Groundwater Cleanup Farget Levels).

d/ $\mu g/kg = micrograms$ per kilogram.

e/ NA = not available.

f/ U = not detected at the laboratory reporting limit shown. g/ · · not applicable.

h/ mg/kg = milligrams per kilogram.

it I = detected at the estimated concentration shown

RESULTS OF CONFIRMATION SOIL SAMPLING AND COMPARISON TO CLOSURE CRITERIA BX SERVICE STATION, SITE ST-29 TABLE 3.1 (Continued)

PATRICK AIR FORCE BASE, FLORIDA

		FDEP	FDEP Target Cleanup	leanup Levels ^{a/}									
	•	Direct E	Direct Exposureb	Soil									Duplicate
Analytes		1	ш	Leachability ^{c/}	SB8-3	SB9-3	SB10-3	SB11-3	SB12-3	SB13-3	SB14-3	SB15-3	SB15
Method SW8021	Units												
1,2-Dichlorobenzene	$\mu g/kg^{d'}$	NA ^{e,}	NA	NA	4.1 U	4.2 U	4.1 U	4.1 U	4.2 U	4.1 U	4.4 U	4.3 U	4.3 U
1,3-Dichlorobenzene		Y N	NA	NA	4.1 U	4.2 U	4.1 U	4.1 U	4.2 U	4.1 U	4.4 U	4.3 U	4.3 U
1,4-Dichlorobenzene		NA VA	NA	NA	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.2 U	3.2 U
Benzene		1,100	1,500	7	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U
Chlorobenzene		NA	ΥN	NA A	2 U	2.1 U	2 U	2 U	2.1 U	2.1 U	2.2 U	2.1 U	2.1 U
Ethylbenzene		240,000	240,000	400	2 U	2.1 U	2 U	2 U	2.1 U	2.1 U	2.2 U	18.5	18.2
m,p-Xylenes		NA	NA	NA	2 U	3.4	1.3 J	2.3	2.1 U	2.1 U	2.7	5.7	9
o-Xylene		NA	NA	NA	2 U	$1.1 \mathrm{J}^{\prime\prime}$	2 U	2 U	2.1 U	2.1 U	2.2 U	4.8	5.1
Total Xylenes		290,000	290,000	300	:	4.5J	3.31	4.33	ı	:	4.91	10.5	11.1
MTBE		350	6,100	200	2 U	2.1 U	2 U	2 U	2.1 U	2.1 U	2.2 U	2.1 U	2.1 U
Toluene		300,000	2,000,000	400	2 U	1.13	2 U	2 U	2.1 U	2.1 U	2.2 U	1.1 J	1.3 J
Method SW8310													
Acenapthene	μg/kg	2,300,000	22,000,000	4,000	1220 U	1250 U	1220 U	1220 U	1250 U	1240 U	1320 U	1280 U	1280 U
Acenapthylene		1,100,000	11,000,000	22,000	1570 U	1600 U	1570 U	1570 U	1600 U	1590 U	1690 U	1640 U	1640 U
Anthracene		19,000,000	290,000,000	2,000,000	449 U	458 U	449 U	449 U	458 U	454 U	484 U	468 U	468 U
Benzo(a)anthracene		1,400	5,100	2,900	9.2 U	9.4 U	9.2 U	9.2 U	9.4 U	9.3 U	0.9 U	4.7 J	4.6 J
Benzo(a)pyrene		100	200	7,800	15 U	16 U	15 U	15 U	5.3	15 U	16 U	9 J	7.3
Benzo(b)fluoranthene		1,400	2,000	6,800	12 U	12 U	12 U	12 U	7.3	12 U	13 U	4 J	6.1
Benzo(g,h,i)perylene		2,300,000	45,000,000	13,000,000	51 U	52 U	51 U	51 U	16 J	52 U	55 U	18 J	18 J
Benzo(k)fluoranthene		15,000	52,000	25,000	11 U	11 U	11 U	11 U	11 U	11 U	12 U	12 U	12 U
Chrysene		140,000	490,000	80,000	102 U	104 U	102 U	102 U	104 U	103 U	110 U	106 U	106 U
Dibenzo(a,h)anthracene		100	200	14,000	20 U	21 U	20 U	20 U	21 U	21 U	22 U	21 U	21 U
Fluoranthene		2,800,000	45,000,000	550,000	143 U	146 U	143 U	143 U	146 U	144 U	154 U	149 U	149 U
Fluorene		2,100,000	24,000,000	87,000	143 U	146 U	143 U	143 U	146 U	144 U	154 U	149 U	149 U
Indeno(1,2,3-cd)pyrene		1,500	5,200	28,000	31 U	31 U	31 U	31 U	10	31 U	33 U	10 J	10 J
Naphthalene		1,000,000	8,600,000	1,000	1220 U	1250 U	1220 U	1220 U	1250 U	1240 U	1320 U	1280 U	1280 U
Phenanthrene		1,900,000	29,000,000	120,000	429 U	438 U	429 U	429 U	438 U	433 U	462 U	447 U	447 U
Pyrene		2,200,000	40,000,000	570,000	184 U	188 U	184 U	184 U	188 U	186 U	198 U	191 U	191 U
Method FLA PRO													
Total Recoverable	mg/kg ^{h/}	350	2,500	340	10.2 U	10.4 U	10.2 U	10.2 U	10.4 U	10.3 U	11.0 U	009	10.6 U
Petroleum Hydrocarbons			•										
a/ FDEP, 1997.													

a. P.D.F., 1997.
 b. Direct Exposure I and II are for No Further Action Without or With Conditions, respectively.

c/ Based on Table V (Groundwater Cleanup Target Levels).

 $f' \ U = not detected at the laboratory reporting limit shown.$ d/ μg/kg = micrograms per kilogram. e/ NA = not available.

g/ -- not applicable.

h/ mg/kg = milligrams per kilogram.

i/J = detected at the estimated concentration shown

^{022/726876/}PATRICK/4.xls

pilot-scale bioventing system installation in March 1993), ethylbenzene at 320,000 μ g/kg (from MPA at 3.5 feet bgs during pilot-scale bioventing system installation in March 1993), total xylenes at 2,600,000 μ g/kg (from HVW-2 at 4.5 feet bgs), and TRPH at 2,730 mg/kg (from HVW-2 at 4.5 feet bgs), PAHs, chlorobenzene, dichlorobenzenes, MTBE, and PAHs were not analyzed for in previous sampling events.

3.2 SOIL TARGET CLEANUP LEVELS

The Petroleum Contamination Site Cleanup Criteria (Chapter 62-770, FAC) (FDEP, 1997) were developed as guidance for determining remedial requirements for closure of petroleum-contaminated sites, including several mechanisms for determining matrix-specific cleanup criteria. The regulations allow closure of petroleum release sites under several different scenarios, including:

- NFA Without Conditions, or
- NFA With Conditions.

Closure of a site under the NFA-without-conditions alternative would allow unrestricted future use of the site (e.g., residential land use), and therefore the requirements and allowable contaminant levels under this alternative are the most restrictive. The NFA-with-conditions alternative requires that appropriate institutional or engineering controls be implemented to limit receptor exposure to contaminated media; sites seeking closure under this alternative are subject to potentially less stringent cleanup levels. These options are defined further in the following subsections.

3.2.1 No Further Action Without Conditions

Closure of a petroleum release site under an NFA proposal without conditions requires that a site meet the following criteria (FDEP, 1997):

- No free-phase light nonaqueous-phase liquid (LNAPL) is present;
- No fire or explosion hazard is present due to release of petroleum or petroleum products;
- No "excessively contaminated soil" is present; and
- Matrix-specific target cleanup levels (TCLs) for soil and groundwater are met.

Contaminant concentrations in all affected media at a site must be below all applicable TCLs for the site to qualify for a NFA without conditions proposal. The *Petroleum Contamination Site Cleanup Criteria* (FDEP, 1997) provides matrix-specific direct-exposure TCLs for petroleum constituents in the form of "look-up" tables for residential and industrial direct-exposure scenarios or through reference to other applicable regulations (i.e., state groundwater or surface water regulations). Level I values (Table 3.1) are the direct-exposure residential TCLs for soil at sites seeking NFA without conditions.

To demonstrate that soil contaminated above TCLs is not present in the unsaturated zone, representative soil samples must show that concentrations of the applicable petroleum constituents are less than FDEP (1997) direct human exposure and soil leachability TCLs. If leachability TCLs are exceeded, direct leachability testing can be performed to determine if leachate concentrations exceed the applicable groundwater TCLs. In addition, the rule also allows for the development of alternative cleanup levels that can be used in place of those presented in the look-up tables. The alternative cleanup levels must be developed based on site-specific exposure scenarios and risk assessment.

3.2.2 No Further Action With Conditions

Closure of a petroleum release site under an NFA proposal with conditions requires that a site meet the first three criteria for NFA without conditions (Section 3.3.1); however, alternative TCLs may be justified by the property owner by agreeing to the enforcement of institutional controls (i.e., land use restrictions) and/or engineering controls. For soil, less restrictive industrial direct-exposure TCLs (Level II in Table 3.1) may be used, and leachability target cleanup levels may be exceeded if it can be demonstrated, based on site characteristics and restrictions specified in the institutional control, that petroleum constituents will not leach into groundwater at concentrations exceeding applicable groundwater target cleanup levels.

3.3 COMPARISON OF CONFIRMATION SAMPLING RESULTS TO CLEANUP LEVELS

Confirmation soil analytical results are compared to FDEP (1997) TCLs in Table 3.1. For all compounds, with the exception of TRPH at SB15, detected concentrations or laboratory reporting limits are below the residential direct-exposure and leachability TCLs. The one TRPH detection of 600 mg/kg exceeds the residential direct-exposure TCL of 350 mg/kg and the soil leachability TCL of 340 mg/kg, but is less than the industrial direct-exposure TCL of 2,500 mg/kg. TRPH were not detected in the replicate soil sample collected at SB15 indicating that soil contamination is very localized and not widespread. With the exception of this one TRPH detection, vadose zone soils at the BX Service Station meet the FDEP (1997) requirements for NFA without conditions.

CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

Approximately 4.5 years of SVE and bioventing treatment of vadose zone soils at the BX Service Station have successfully reduced the concentrations of BTEX and PAHs to concentrations below analytical reporting levels for nearly all compounds, and to levels significantly below the FDEP (1997) TCLs for NFA without conditions. The residual BTEX compounds that were detected are at concentrations significantly below the FDEP (1997) TCLs for closure without conditions. TRPH were detected in one soil sample at concentrations exceeding NFA without conditions criteria; however, sample results strongly suggest that residual TRPH contamination is not widespread and does not represent a significant human contact or groundwater threat.

4.2 RECOMMENDATIONS

Based on the soil analytical results summarized in Table 3.1, the vadose zone soils meet criteria for closure with no conditions. It is recommended that the bioventing system be dismantled and removed from the site, and that the HVWs and MPs be properly abandoned. The blower and blower shed are the property of Patrick AFB.

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APPENDIX A
CONFIRMATION SAMPLING AND ANALYSIS PLAN

FINAL

Confirmation Sampling and Analysis Plan for the BX Service Station, Facility 736, Site ST-29



Patrick Air Force Base Florida

Prepared For

Air Force Center for Environmental Excellence Brooks Air Force Base, Texas

and

45 CES/CEV Patrick Air Force Base, Florida

June 1998



FINAL

CONFIRMATION SAMPLING AND ANALYSIS PLAN FOR THE BX SERVICE STATION, FACILITY 736, SITE ST-29

PATRICK AIR FORCE BASE FLORIDA

Prepared for:

Air Force Center for Environmental Excellence Brooks Air Force Base, Texas

and

45 CES/CEV Patrick Air Force Base, Florida

June 1998

Prepared by:

Parsons Engineering Science, Inc. 1700 Broadway, Suite 900 Denver, Colorado 80290

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ACRONYMS AND ABBREVIATIONS

45 CES/CEV 45th Civil Engineering Squadron/Environmental Flight

AFB Air Force Base

AFCEE Air Force Center for Environmental Excellence

AS Air Station

AST aboveground storage tank bgs below ground surface

BTEX benzene, toluene, ethylbenzene, and xylenes

BX Base Exchange

CAR contamination assessment report COPC chemical of potential concern

CPT cone penetrometer

CW compliance monitoring well

EP extraction procedure
ES Engineering-Science, Inc.

ESE Environmental Science & Engineering, Inc.

FAC Florida Administrative Code

FDEP Florida Department of Environmental Protection

HVW horizontal vent well

ICE internal combustion engine
LIF laser-induced fluorescence
LNAPL light nonaqueous-phase liquid

LTM long-term monitoring micrograms per kilogram μg/kg micrograms per liter $\mu g/L$ milligrams per kilogram mg/kg milligrams per liter mg/L MOGAS motor vehicle gasoline MP monitoring point MTBE methyl tert-butyl ether NFA no further action

NRMRL National Risk Management Research Laboratory

PAH polynuclear aromatic hydrocarbon
PAMP Petroleum Action Management Plan
Parsons ES Parsons Engineering Science, Inc.

PID photoionization detector POC point of compliance

ppmv parts per million, volume per volume

QC quality control RAP remedial action plan

SAP Sampling and Analysis Plan

SVE soil vapor extraction

TCLP toxicity characteristic leaching procedure

TPH total petroleum hydrocarbons

	•
TRPH	total recoverable petroleum hydrocarbons
TVH	total volatile hydrocarbons
TVHA	total volatile hydrocarbon analyzer
USCS	Unified Soil Classification System
USEPA	US Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

INTRODUCTION

This confirmation sampling and analysis plan (SAP) for the Base Exchange (BX) Service Station, Facility 736, Site ST-29, at Patrick Air Force Base (AFB), Florida has been prepared by Parsons Engineering Science, Inc. (Parsons ES) for submittal to the Florida Department of Environmental Protection (FDEP); the US Air Force Center for Environmental Excellence (AFCEE), Brooks AFB, Texas; and 45th Civil Engineering Squadron/Environmental Flight (45 CES/CEV), Patrick AFB, Florida. The SAP is intended to guide soil sampling at the site to document the effectiveness of remediation of petroleum-hydrocarbon-contaminated soils using *in situ* bioventing. The BX Service Station has been in service since 1954, and is the primary on-Base "gas station" used by military personnel and their families. Petroleum contamination has been identified in site soils and groundwater primarily as a result of leaks in former motor vehicle gasoline (MOGAS) underground storage tanks (USTs) and the associated piping. There is no evidence of mobile light nonaqueous-phase liquid (LNAPL, "free-phase product") at this site.

In 1992, the BX Service Station was selected as a pilot test site for the AFCEE Bioventing Initiative. The purpose of this initiative was to determine if in situ bioventing would be a feasible cleanup technology for source area petroleum-contaminated soils within the unsaturated zone. Under the initiative, Parsons ES (formerly Engineering-Science, Inc. [ES, 1993]) installed a pilot-scale bioventing system at the BX Service Station in March 1993, and performed initial pilot testing. Prior to extended pilot testing using air injection bioventing, soil vapor extraction (SVE) was performed for 3 months to reduce high concentrations of total volatile hydrocarbons (TVH) in vadose zone soils. Following SVE and a 96-percent reduction of TVH in extracted soil gas, the system was reconfigured for air injection bioventing and operated for an additional 9 months prior to 1-year testing. Results of the 1-year pilot test demonstrated that SVE and air injection bioventing had effectively treated petroleum-contaminated soils in the area influenced by the pilot-scale system.

In September 1994, the BX Service Station was included in the AFCEE Extended Bioventing project and funded for system expansion (Option 4), extended bioventing system operation followed by soil gas sampling and in situ respiration testing (Option 1), and confirmation/closure sampling (Option 2) following sufficient bioventing treatment of site soils. In November 1996, soil gas sampling and respiration testing was performed following approximately 15 months of expanded bioventing system operation, and results indicated that benzene, toluene, ethylbenzene, and xylenes (BTEX) concentrations in vadose zone soils had been significantly reduced (Parsons ES, 1997a). An additional 6 months to 1 year of continued system operation was

recommended by Parsons ES and AFCEE, prior to initiating confirmation/closure sampling activities, because of elevated TVH concentrations in soil gas at one location. To date, soils in the vicinity of the original pilot-scale system have benefited from more than 3.5 years of soil venting, and soils influenced by the expanded bioventing system have received more than 2.5 years of treatment. Based on previous sampling results and extended system operation, petroleum hydrocarbon concentrations in vadose zone soils are likely to meet revised FDEP (1997) soil target cleanup levels which appear in Chapter 62-770 of the Florida Administrative Code (FAC), as listed in Section 3 of this SAP.

The objective of the confirmation sampling is to document the effectiveness of *in situ* bioventing for the remediation of petroleum-hydrocarbon contaminated soils. The site is currently under a long-term monitoring status. The proposed confirmation sampling described in Section 4 targets unsaturated and smear zone soils in the vicinity of the current fuel dispensing island and the MOGAS USTs. It is anticipated that soil analytical results will meet FDEP (1997) risk-based criteria for NFA, and that no further soil remediation will be necessary.

This SAP consists of nine sections, including this introduction, and one appendix. Section 2 includes a site description and history, and summaries of previous investigations and remediation activities. Section 3 summarizes cleanup requirements for the BX Service Station. A detailed SAP is presented in Section 4. Analytical results will be presented in a confirmation sampling report, as described in Section 5. Section 6 lists Patrick AFB support requirements, and Section 7 presents the proposed project schedule. Air Force, regulatory, and contractor points of contact are provided in Section 8, and references for this SAP are provided in Section 9. Appendix A provides pertinent groundwater analytical data from previous sampling events.

SITE DESCRIPTION

2.1 SITE LOCATION AND PROJECT HISTORY

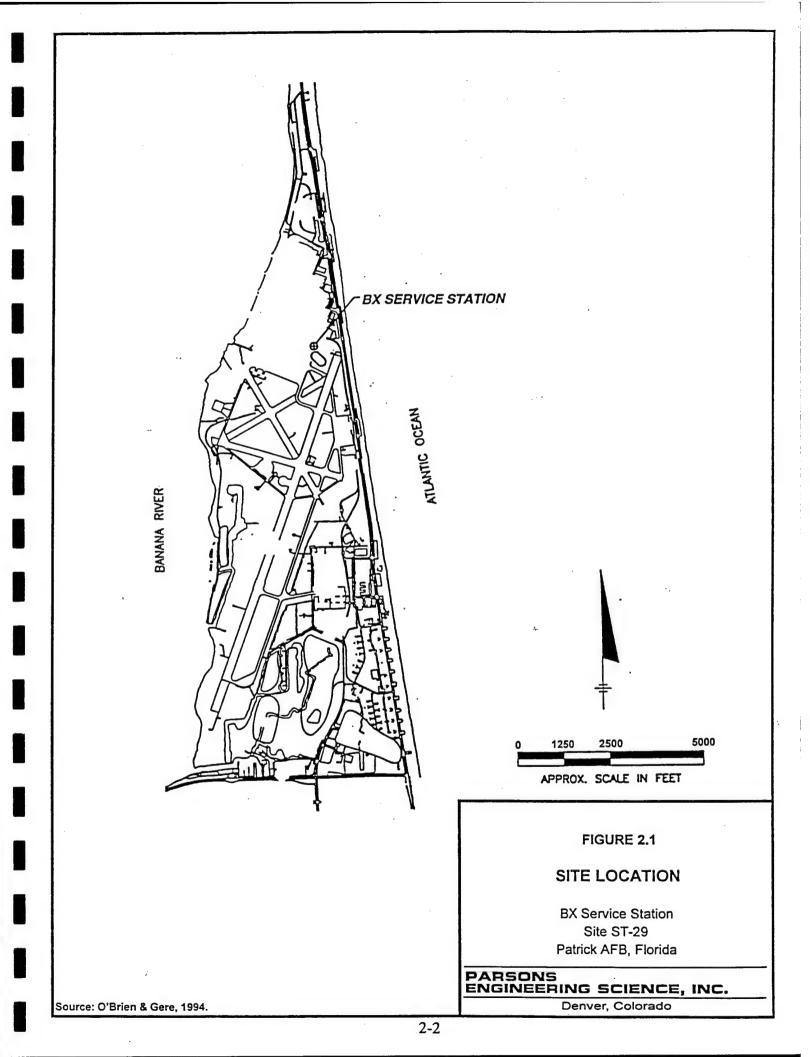
Patrick AFB lies on a long barrier island situated off Florida's east coast, in Brevard County. Patrick AFB is bounded on the east by the Atlantic Ocean and on the west by the Banana River. The City of Cocoa Beach is located immediately north of the Base, and Satellite Beach is directly south. The BX Service Station is located in the north-central section of Patrick AFB (Figure 2.1).

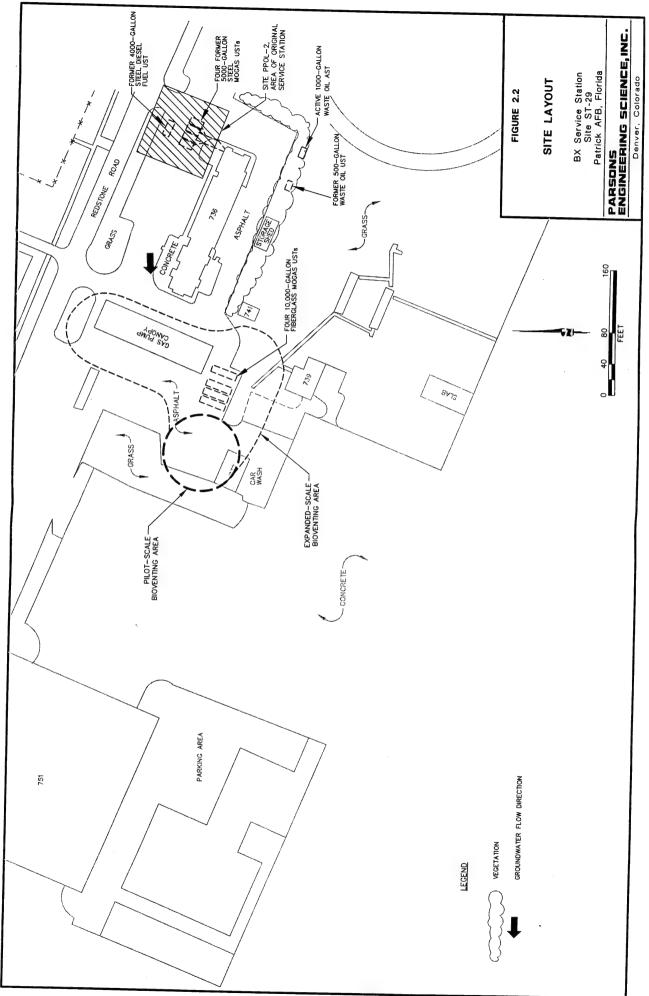
The original service station area is located to the northeast of the existing building (Building 736), as shown on Figure 2.2. The original service station (Site PPOL-2) consisted of four former 5,000-gallon steel USTs that contained MOGAS, a former 4,000-gallon steel UST that contained diesel fuel, and two former dispenser islands and the associated piping. The former dispenser islands were located above the USTs. During a major renovation in 1973, the dispenser islands were removed, the original USTs were abandoned in place, and the original service station area was paved over with asphaltic concrete. New fueling facilities consisting of dispenser islands, five 10,000-gallon fiberglass USTs for MOGAS, and associated piping were installed in their current locations west and southwest of Building 736 (Figure 2.2).

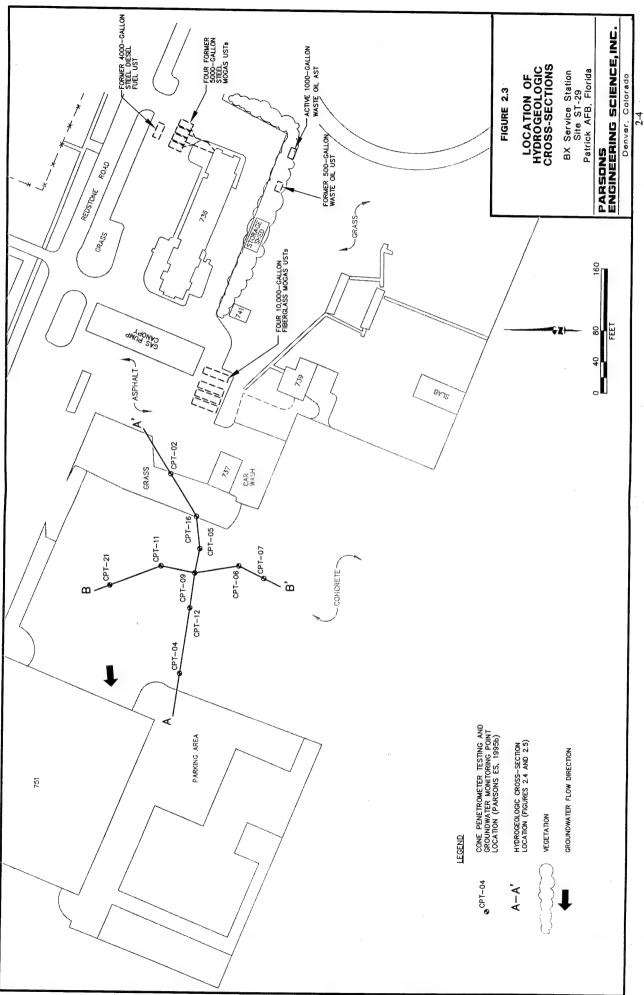
In 1985, a leak was detected in a fiberglass fuel line, and in 1986, one of the 10,000-gallon fiberglass USTs was removed due to leakage. It is estimated that approximately 700 gallons of MOGAS was released into the subsurface as a result of the fuel line and UST leaks (Environmental Science & Engineering, Inc., [ESE], 1991). In February 1992, a 500-gallon UST southeast of Building 736 was removed and replaced with a 1,000-gallon waste oil aboveground storage tank (AST). In 1993, the five abandoned USTs located northeast of Building 736 were excavated and removed along with some excessively contaminated soils (O'Brien & Gere Engineers, Inc. [OB&G], 1995).

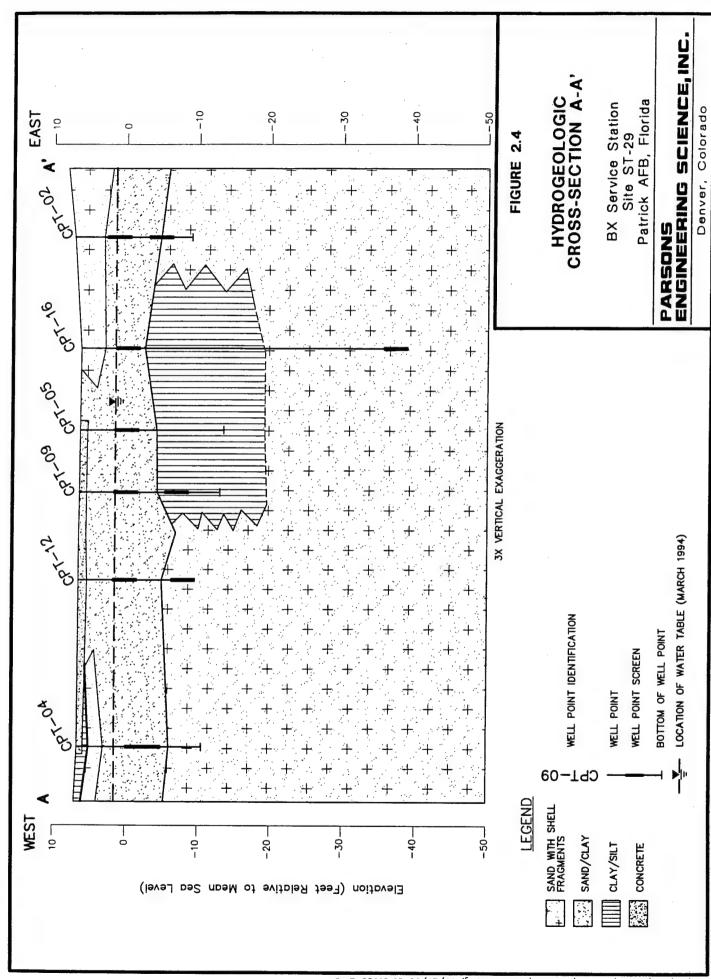
2.2 SITE GEOLOGY AND HYDROGEOLOGY

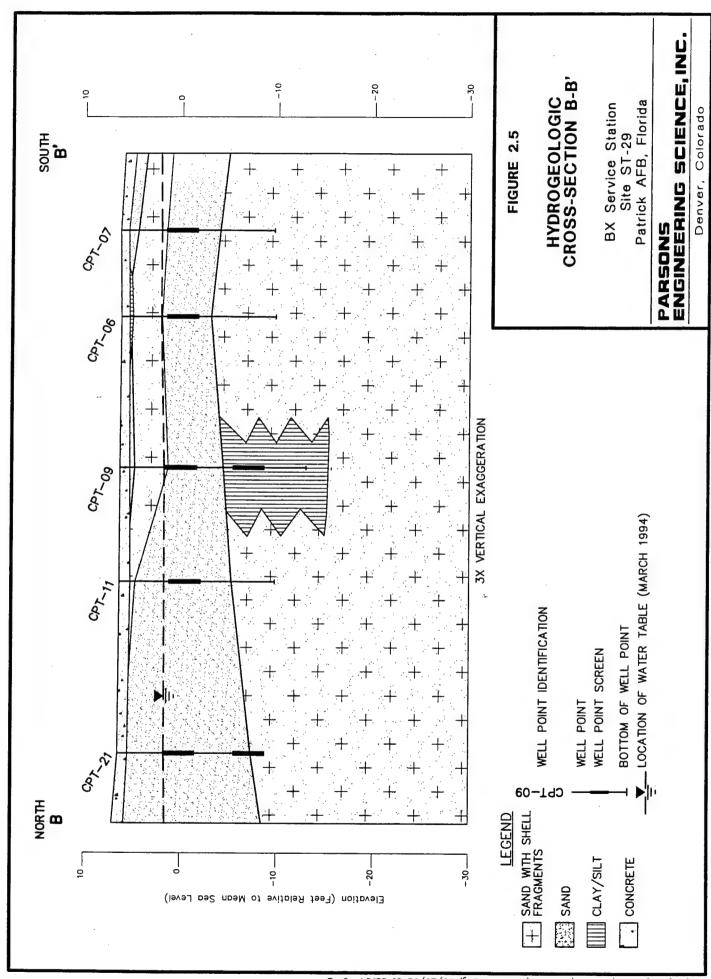
The BX Service Station is characterized by a level ground surface covered primarily with asphalt and concrete pavement. Soils at this site consist of predominantly unconsolidated, poorly to moderately well-sorted, fine- to coarse-grained quartz sand with up to 40-percent shell fragments. This marine sand deposit extends to approximately 25 feet below ground surface (bgs). Figure 2.3 shows the locations of two hydrogeologic cross-sections, which are shown on Figures 2.4 and 2.5.











Shallow groundwater at the site is unconfined and typically encountered in the sand at approximately 4 to 6 feet bgs. Historical groundwater elevation data indicate that groundwater flow at the site is generally to the west (ESE, 1991; Parsons ES, 1995b). The horizontal hydraulic gradient at the site ranges from 0.00096 to 0.003 foot per foot (ESE, 1991; OB&G, 1992; Parsons ES, 1995b). The advective groundwater velocity is estimated to be 160 feet per year (Parsons ES, 1995b). Groundwater at Patrick AFB has been designated as Class G-II under State of Florida classifications (ESE, 1991). Class G-II groundwater is acceptable for potable use, with a total dissolved solids content less than 10,000 milligrams per liter [mg/L]). However, shallow groundwater at the site and groundwater at Patrick AFB is not used for potable drinking water. The Base gets its potable water supply from the City of Cocoa (OB&G, 1995).

2.3 PREVIOUS INVESTIGATIONS

2.3.1 1990 Phase II, Stage 2 Investigation by ESE

As a result of the leaking pipe discovered in 1985, and the removal of one 10,000-gallon fiberglass MOGAS UST in 1986, a Phase II, Stage 2 investigation was conducted by ESE (1991) in the western and northwestern areas of the BX Service Station near the active USTs and dispenser island (Figure 2.2). During this investigation, soil samples were collected from eight boreholes (SB-1 through SB-8); five shallow monitoring wells (PPOL2-1 through PPOL 2-5) and one deep monitoring well (PPOL2-6) were installed; and two rounds of groundwater samples were collected. Soil sample results from this investigation are shown in Table 2.1, and groundwater sample results are presented in Appendix A. Soil and groundwater sampling locations are shown on Figure 2.6.

Soil samples were analyzed for total recoverable petroleum hydrocarbons (TRPH), lead, volatile organic compounds (VOCs), and leachable extraction-procedure (EP) toxic metals. Elevated concentrations of TRPH, toluene, ethylbenzene, and xylenes were detected in samples collected from Boreholes SB-2 (adjacent to Building 737), SB-3 (located south of the four active MOGAS USTs), and SB-8 (adjacent to the active dispensing island). The most significant hydrocarbon contamination was evident at SB-2, where TRPH, ethylbenzene, toluene, and xylenes were detected at concentrations of 386 milligrams per kilogram (mg/kg), 100 mg/kg, 38 mg/kg, and 822 mg/kg, respectively.

Groundwater samples were analyzed for TRPH, total and dissolved lead, purgeable halocarbons, and purgeable aromatic compounds. During Round 2 sampling at monitoring well PPOL2-1, which is located directly west of the existing dispenser islands, the fuel additive methyl tert-butyl ether (MTBE) was detected at 151 micrograms per liter (μ g/L). At monitoring well PPOL2-3, located southwest of the original service station area, total lead was detected at 0.0221 mg/L, and dissolved lead was detected at 0.0029 mg/L.

2.3.2 Original Service Station Investigation and Remediation

A site characterization of the original service station area (Site PPOL-2) northeast of Building 736 (Figure 2.6) was performed by OB&G (1994 and 1995) from April 1993

ESE AND OB&G SOIL ANALYTICAL RESULTS (1990 AND 1993) BX SERVICE STATION SITE ST-29 PATRICK AFB, FLORIDA TABLE 2.1

SB-14 (2-4) (4-6) (2-4) (•													
SB-1 SB-2 SB-3 SB-4 SB-5 SB-6 SB-7 SB-8 SA-4 2.16 40 0.970 15.3 1.15 2.85 SB-3 386 37.3 -\(^4\) -\(^1\) -\(^	Analyte (mg/kg)			Sa	mple Loca	tion/(Dep	(F)										
SB-9 (NA) (NA) (NA) (NA) (NA) (NA) 5.77 5.44 2.16 4.0 0.970 15.3 1.15 2.85 58.3 386 37.3 -w -s 57.0 -s 43.8		SB-I	SB-2	SB-3	SB-4	SB-5	SB-6	SB-7	SB-8								
58.3 386 37.3 -\(\sigma\) -\(\sigma\) - \(\sigma\) - \(\s		(NA°)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)								
58.3 386 37.3 -\tilde{a} 57.0 - 43.8 22.3 38 22 - - 7.4 22.3 822 155 - - - 7.4 SB-9 SB-10 SB-11 SB-12 SB-13 SB-13 SB-14 (2-4) (4-6) (2-4) (4-6) (2-4) (4-6) (4-6) (4-6) (2-4) (2-4) (2-4) (2-4) </td <td>Lead</td> <td>5.77</td> <td>5.44</td> <td>2.16</td> <td>4.0</td> <td>0.970</td> <td>15.3</td> <td>1.15</td> <td>2.85</td> <td></td> <td></td> <td></td> <td>٠</td> <td></td> <td></td> <td></td> <td></td>	Lead	5.77	5.44	2.16	4.0	0.970	15.3	1.15	2.85				٠				
- 100 24 32 22.3 822 155 181 5B-9 6-0 (2-4) (4-6) (2-4) (2-4) (2-4)D ⁰ (4-6) (4-6) (2-4) (4-6) (2-4) (4-6) (2-4) (4-6) (2-4) 0.083 0.041 ^W ^V 0.0031 0.0034 0.0034 0.0041	TRPH	58.3	386	37.3	, F	1	57.0	;	43.8								
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1 1 1 1 1 1 1 1 1 1	TRPH	62.3	130	39.7	54.0	63	39.3	101	•	437	514	39.8	34.5	92.5	191	242	752
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ylnaphthalene 59 28 3.6 threne 0.12J 0.072 0.14J	1-Methylnaphthalene	:	1	:	i	:	!			30	24	:	ı	!	4.4	4.4	28
threne 0.12J 0.072	2-Methylnaphthalene	;	:	:	ı	;	1	:		29	28	;	1	ı	3.6	8.2	62
0.14]	Phenanthrene	:	:	0.12J	1	;	1	:		ł	:	ı	1	:	0.072	;	;
	Pyrene	:	;	0.14J	1	1	:	:		1	1	1	;	1	ł	:	}

" mg/kg = milligrams per kilogram.

^{b/} Soil sample results from 1990 Phase II, Stage 2 investigation.

o' Sample depths not available.

 ω "-." = not detected, detection limit not available.

V Soil sample results from 1993 Petroleum Contamination Assessment, only those analytes that were detected are shown. Soil samples were collected prior to tank and soil excavation.

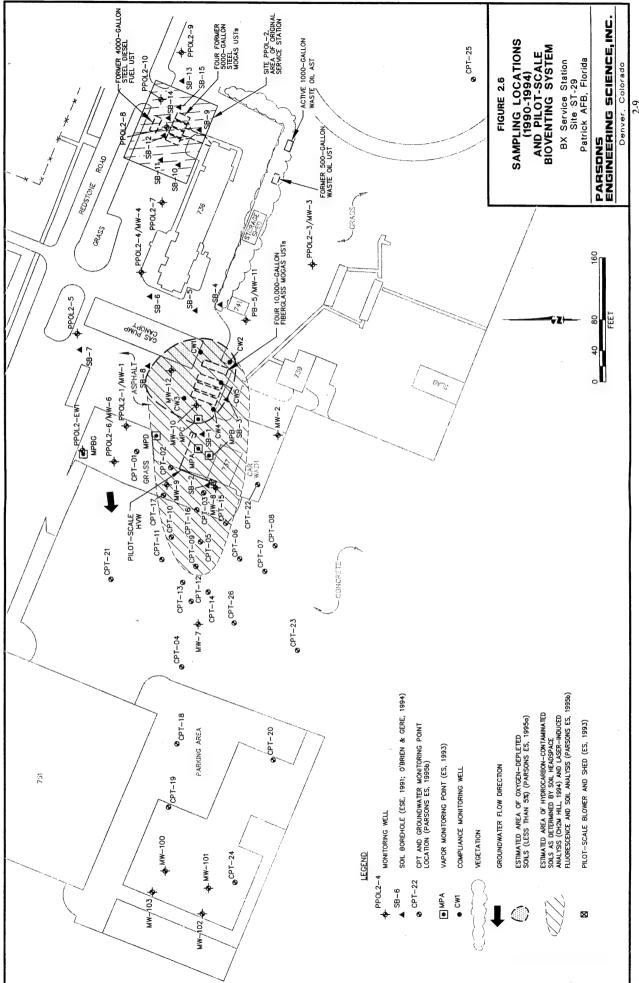
⁰ D = sample replicate.

Analyzed by USEPA Method SW8240.

 $^{M}J = laboratory$ estimated concentration.

¹ Blank result means sample not analyzed for this parameter.

^J Analyzed by USEPA Method SW9073.
^W Analyzed by USEPA Method SW8270.



through July 1994 to evaluate the horizontal and vertical extent of soil contamination, and to assess the potential effects of past releases of MOGAS and/or diesel fuel on shallow groundwater. Results of this study were provided in a Contamination Assessment Report (CAR) for Site PPOL-2 (OB&G, 1995). Soil results are summarized on Table 2.1. Based on soil (Boreholes SB-9 through SB-15) and groundwater (wells PPOL2-4, PPOL2-5, PPOL2-7, PPOL2-8, and PPOL2-9) analytical results from this investigation, petroleum contamination was determined to be most significant in the area of the abandoned USTs and did not extend significantly downgradient. Maximum concentrations of naphthalene (60 mg/kg), 1-methylnaphthalene (28 mg/kg), and 2-methylnaphthalene (62 mg/kg) in soil were detected in the 4- to 6-foot sample interval at SB-15. Elevated concentrations of these polynuclear aromatic hydrocarbons (PAHs) were also detected in the 4- to 6-foot sample interval at SB-12.

Following site investigation activities, the four abandoned MOGAS USTs and one abandoned diesel UST, and approximately 200 tons of excessively contaminated soils were removed between November 30 and December 3, 1993, to eliminate the source of soil and groundwater contamination at the original service station area. Results of the UST closure were documented in a facility engineering report and included as an appendix to the CAR (OB&G, 1995). In January 1996, FDEP (1996) approved an NFA proposal and issued a Site Rehabilitation Completion Order for the original service station area (Site PPOL-2).

2.3.3 March 1994 CH2M Hill Soil Headspace Analysis

In March 1994, a soil headspace analyses investigation was conducted by CH2M Hill (1994) in the vicinity of the active pump islands and USTs west and southwest of Building 736, respectively (Figure 2.6). The soil headspace sampling was performed at 25 locations in accordance with FDEP soil screening guidelines for the headspace analysis method prescribed in FAC, Chapter 17-770.200 (2). The soil vapor VOC headspace readings ranged from 0 to 3,244 parts per million, volume per volume (ppmv) and indicated that soil contamination was most significant immediately adjacent to the pump islands and UST locations.

2.3.4 1994 and 1995 Natural Attenuation Study

As part of a nationwide, multi-site demonstration, Parsons ES (1995b), in conjunction with researchers from the US Environmental Protection Agency (USEPA) National Risk Management Research Laboratory (NRMRL; formerly Robert S. Kerr Environmental Research Laboratory), was retained by AFCEE to conduct site characterization and groundwater modeling at the BX Service Station (Site ST-29) to evaluate the effectiveness of natural attenuation of dissolved fuel contaminants. To support the study, site characterization data, including soil and groundwater sampling and aquifer testing, were collected in March 1994 (by Parsons ES and NRMRL), March 1995 (NRMRL), and May 1995 (CH2M Hill). Cone penetrometer testing (CPT) was conducted to collect stratigraphic information and soil samples in the vicinity of the active pump islands and USTs and downgradient from the site. Groundwater samples were collected at monitoring points installed in CPT boreholes,

and at previously installed monitoring wells. Soil and groundwater sampling locations are shown on Figure 2.6.

Soil samples collected in March 1994 were analyzed for BTEX, total petroleum hydrocarbons (TPH), trimethylbenzene isomers, and total organic carbon. Soil BTEX and TPH data are included in Table 2.2. The highest concentrations of total BTEX and TPH observed during this investigation were from samples collected near the water table (e.g., 5.5 to 6.5 feet bgs) downgradient from the active USTs and pump islands. A total BTEX concentration of 1,236 mg/kg and a TPH concentration of 17,100 mg/kg were detected in the sample collected 6 feet bgs at CPT-02. At CPT-03, a TPH concentration of 11,700 mg/kg was detected in the sample collected 5.5 feet bgs, and a total BTEX concentrations of 975 mg/kg was detected in the 6.5-foot bgs soil sample. Total BTEX concentrations are generally an order of magnitude lower in samples collected 1 to 2 feet above or below these capillary fringe samples. During this investigation, the downgradient extent of smear zone hydrocarbon contamination was estimated to be approximately 220 feet downgradient from the source area (Figure 2.6), where total BTEX and TPH concentrations of 0.0989 mg/kg and 2,740 mg/kg, respectively, were detected in the 5-foot-bgs sample from CPT-09.

Groundwater samples collected in March 1994 (by Parsons ES and NRMRL), in March 1995 (by NRMRL), and in May 1995 (by CH2M Hill) confirmed the presence of fuel-hydrocarbon contamination in the shallow saturated zone in the vicinity of the BX Service Station and extending downgradient to an area just south of Building 751 (Figure 2.6). Dissolved BTEX contamination has migrated west of the active USTs and pump islands in the direction of groundwater flow; however, data collected between March 1994 and March/May 1995 indicate that natural chemical attenuation processes have been effective in preventing further downgradient migration of the dissolved BTEX plume. Groundwater contaminant and geochemical data indicate that biodegradation is reducing dissolved contaminant mass, and the BTEX plume shrank in both the longitudinal and lateral directions between March 1994 and March/May 1995 (Parsons ES, 1995b). Tables and figures summarizing groundwater contaminant data and distribution based on these sampling events are provided in Appendix A.

The results of the study suggest that natural attenuation of dissolved BTEX compounds is occurring at sufficient rates to reduce concentrations below regulatory guidelines before potential downgradient receptors could be adversely affected. The study recommended the use of long-term monitoring (LTM) wells and point-of-compliance (POC) monitoring wells to monitor the long-term migration and degradation of the dissolved BTEX plume (Parsons ES, 1995b). The study also recommended continued bioventing until source area contamination in site soils was sufficiently reduced.

2.4 PILOT-SCALE AND EXPANDED-SCALE BIOVENTING

As part of the AFCEE Bioventing Initiative, ES (1993) installed a pilot-scale bioventing system at the BX Service Station in March 1993 to assess the potential for air injection bioventing to remediate the hydrocarbon contamination identified in vadose zone soils. The primary objectives of the pilot test were: 1) to assess the potential for

TABLE 2.2 PARSONS ES SOIL ANALYTICAL RESULTS (1993-1995)

BX SERVICE STATION

SITE ST-29

PATRICK AFB, FLORIDA

				Analyte ^{2/}		
Sampling Event/	Depth	TPH	Benzene	Toluene	Ethylbenzene	Xylenes
Sample Location	(ft bgs) ^{b/}	(mg/kg) ^{c/}	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
March 1994 Natural						
Attenuation Study ^{d/}						
CPT-02-A17	4	ND ^{e/}	<0.02	< 0.02	0.0345	0.1085
CPT-02-A18	5	140	0.197	0.0605	0.514	3.119
CPT-02-A19	6	17,100	6.99	8.08	191	1,030
CPT-02-A20	6.45	1,660	0.68	0.345	16.1	84.1
CPT-02-A21	7	289	0.339	0.106	2.26	12.42
CPT-03-A22	3	20.9	0.164	0.0142	0.21	1.019
CPT-03-A23	4.5	0.2	ND	< 0.02	0.00838	0.0418
CPT-03-A24	5.5	11,700	< 0.02	0.462	< 0.02	171.3
CPT-03-A25	6.5	9,300	2.33	29.5	120	823
CPT-03-A26	7	287	0.366	0.532	2.02	15.46
CPT-05-A1	3.5	ND	< 0.02	< 0.02	< 0.02	< 0.02
CPT-05-A2	4.5	ND	< 0.02	< 0.02	< 0.02	< 0.02
CPT-05-A3	5	ND	< 0.02	< 0.02	< 0.02	0.00725
CPT-05-A4	5.5	ND	< 0.02	< 0.02	< 0.02	< 0.02
CPT-09-A4	2.5	2	< 0.02	< 0.02	ND	< 0.02
CPT-09-A5	4.5	47.1	< 0.02	< 0.02	< 0.02	< 0.02
CPT-09-A6	5	2,740	< 0.02	0.034	< 0.02	0.0649
CPT-09-A7	6	15.2	< 0.02	< 0.02	< 0.02	< 0.02
CPT-13	5.5	ND	< 0.02	< 0.02	<0.02	< 0.02
CPT-15-A8	3	ND	< 0.02	< 0.02	ND	< 0.02
CPT-15-A9	4	0.01	< 0.02	< 0.02	ND	< 0.02
CPT-15-A10	5	526	< 0.02	0.012	0.00978	0.0226
CPT-15-A11	5.5	ND	ND	ND	< 0.02	< 0.02
CPT-16-A1	4.5	0.04	0.00752	0.00761	< 0.02	< 0.02
CPT-16-A2	6	ND	ND	< 0.02	ND	< 0.02
CPT-17-A12	2	ND	ND	< 0.02	< 0.02	< 0.02
CPT-17-A13	3 ·	ND	ND	< 0.02	ND	< 0.02
CPT-17-A14	4	ND	ND	< 0.02	< 0.02	0.00779
CPT-17-A15	5	ND	ND	< 0.02	ND	< 0.02

TABLE 2.2 (Continued) PARSONS ES SOIL ANALYTICAL RESULTS (1993-1995)

BX SERVICE STATION

SITE ST-29

PATRICK AFB, FLORIDA

				Analyte ^{a/}		
Sampling Event/	Depth	TRPH	Benzene	Toluene	Ethylbenzene	Xylenes
Sample Location	(ft bgs) ^{b/}	(mg/kg) ^{c/}	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Pilot-Scale Bioventing March 1993 ^{g/}						
HVW-2	4.5	2,730	< 14 ^{b/}	54	260	2,600
MPA	3.5	11	< 6.2	23	320	140
MPC	3.5	60	< 0.31	< 0.36	< 0.26	5.7
December 1994						
HVW-2	4.5	81.9	< 0.05	< 0.05	< 0.05	< 0.099
MPA	3.5	50.8	< 0.049	< 0.049	< 0.049	< 0.098
MPC	3.5	57.6	0.13	0.15	0.16	0.49
Expanded-Scale Bioventin July 1995 ^{j/}	ng					
MPE	3.5	743	0.075	< 0.05	20	160
MPF	3.5	767	0.47	0.57	7.4	9.0
CW2	3.5	13.3	< 0.05	< 0.05	< 0.05	< 0.13

For natural attenuation study, total petroleum hydrocarbons (TPH) quantified with a JP-4 jet fuel standard. For pilot-scale and expanded-scale bioventing, total recoverable petroleum hydrocarbons (TRPH) analyzed by USEPA Method 418.1; benzene, toluene, ethylbenzene, and total xylenes analyzed by USEPA Method SW8020.

b' ft bgs = feet below ground surface.

e' mg/kg = milligrams per kilogram.

^d Parsons ES, 1995a.

e' ND = not detected and detection limit not available.

v < = below limit of quantitation shown for natural attenuation study results.

g/ ES, 1993. Soil samples collected prior to pilot-scale bioventing system startup.

by <= analyte concentration in sample was less than the method detection limit shown for bioventing results.

V Soil samples collected following approximately 3 months of soil vapor extraction and 9 months of pilot-scale bioventing system operation.

^y Soil samples collected during full-scale bioventing system installation.

supplying oxygen throughout the contaminated soil profile; 2) to determine the rate at which indigenous microorganisms would degrade petroleum hydrocarbons when stimulated by oxygen-rich soil gas at this site; and 3) to evaluate the potential for sustaining these rates of biodegradation until hydrocarbon contamination is remediated below regulatory approved standards (ES, 1993).

The pilot test location and system configuration were based on results of a soil gas survey performed by ES in January 1993 in the vicinity of SB-2. The soil gas survey indicated TVH concentrations exceeding 10,000 ppmv and depleted oxygen conditions in soils immediately north of the car wash, Building 737 (ES, 1993). The pilot-scale bioventing system consisted of one horizontal vent well (HVW-2), five vapor monitoring points (MPA, MPB, MPC, MPD, and MPBG), a 1-horsepower regenerative blower, blower piping and gauges, and a weatherproof blower shed (see Figure 2.6). The HVW was installed at the site at a depth of approximately 4 feet bgs because of the relatively shallow water table. At each of the MPs, a single screened interval was placed from 3.0 to 3.5 feet bgs. During installation and testing of the pilot-scale system, soil and soil gas sampling, and respiration and soil-to-air permeability testing were performed. Based on results of the oxygen influence and air permeability testing, the long-term radius of oxygen influence around the HVW was expected to exceed 37 feet. A detailed description of the pilot-scale bioventing system design and initial testing results are provided in the Draft Interim Pilot Test Results Report (ES, 1993).

Prior to extended operation of the pilot-scale air injection bioventing system. SVE was performed at the BX Service Station site to reduce the potential for uncontrolled VOC vapor migration and discharge to the atmosphere. Soil gas samples collected during the January 1993 soil gas survey and initial soil gas samples collected following pilot-scale bioventing system installation indicated significant concentrations of TVH in soil gas at the site, and the need for a short period of SVE prior to air injection bioventing. The SVE system utilized a modified internal combustion engine (ICE) for the removal and destruction of hydrocarbon vapors extracted from fuel-contaminated soils at the site (AFCEE, 1994). The SVE system was operated from October 18, 1993 through January 14, 1994, when the blower was reconfigured for air injection Startup of the bioventing system immediately followed SVE system shutdown and continued until November 1994. One-year respiration testing and soil gas sampling was performed in December 1994, following 1 month of system shutdown to allow equilibrium conditions to develop in site soils, for comparison to initial results. Following the 1-year testing event, the system was started and reoptimized for continuous air injection.

In December 1994, during the collection of 1-year data for the pilot-scale system, Parsons ES performed a soil gas survey in the vicinity of the active pump islands and USTs to supplement the March 1994 CH2M Hill investigation (Section 2.3.3). The results from this survey indicated that the extent of remaining unsaturated soil contamination was localized around the active pump islands and USTs west and southwest of Building 736, and that soil gas oxygen levels in this area were depleted (less than 5 percent). The estimated area of oxygen depletion based on this survey is shown on Figure 2.6.

Based on favorable 1-year testing results for the pilot-scale bioventing system, and the presence of contaminated soil outside the effective treatment area of HVW-2, the BX Service Station site was added to the AFCEE Extended Bioventing Project (Contract No. F41624-92-D-8036, Order 17, awarded by AFCEE to Parsons ES on 30 September 1994). Under the extended bioventing project, funding was allocated for bioventing system expansion at the site (Option 4); for an additional year of system operation and testing (Option 1); and for confirmation/closure soil sampling (Option 2), following sufficient remediation of petroleum-hydrocarbon-contaminated soils.

In preparation for bioventing system expansion, Parsons ES (1995a) developed an Initial Remedial Action Plan and performed a supplemental soil headspace survey in May 1995. The survey further delineated the soils to be remediated through bioventing system expansion. Following Patrick AFB, AFCEE, and FDEP approval of the Initial Remedial Action Plan, the expanded full-scale bioventing system was installed in July 1995 in the vicinity of the active pump islands and USTs. The expanded-scale system consists of two additional HVWs (HVW-1 and HVW-3), five additional MPs (MPE, MPF, MPG, MPH, and MPI), and a new blower system. A layout of the expanded-scale bioventing system is presented on Figure 2.7.

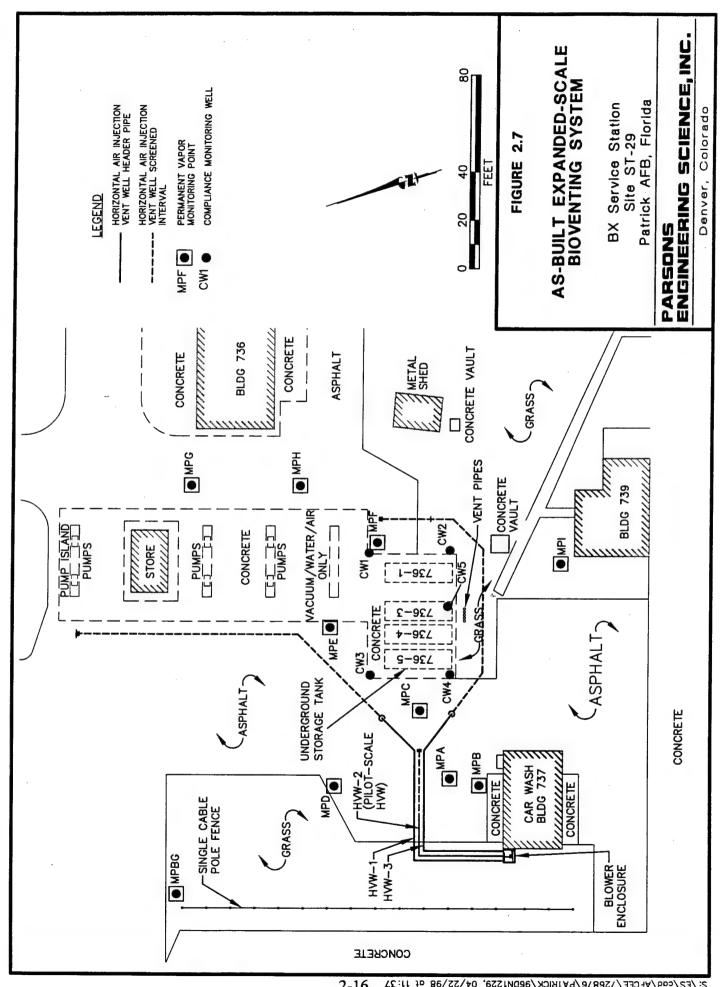
Expanded-scale system operation began on July 12, 1995. Option 1 soil gas sampling and respiration testing was performed in early November 1996, following 1 month of system shutdown to allow equilibrium conditions to develop in site soils and to allow comparison to initial and 1-year results. Results of the Option 1 testing event were presented in a Parsons ES (1997a) letter report to AFCEE and Patrick AFB. The expanded-scale bioventing system was restarted following Option 1 testing. In March 1997, Parsons ES revisited the site to perform a systems maintenance check. Site measurements demonstrated that the entire area designated for treatment was receiving oxygen as a result of expanded-scale bioventing system operation (Parsons ES, 1997b).

2.4.1 Soil Sampling Results

Soil sampling by Parsons ES was conducted at the BX Service Station site during installation of the pilot-scale bioventing system (March 1993), after 12 months of SVE/pilot-scale air injection bioventing (December 1994), and during installation of the full-scale bioventing system (July 1995). A summary of the pilot-scale and expanded-scale soil analytical results is provided in Table 2.2.

The TRPH concentrations in soils sampled from the immediate vicinity of the pilot-scale horizontal vent well decreased 1 to 2 orders of magnitude between March 1993 and December 1994. TRPH concentrations at MPA and MPC showed little contamination prior to SVE and pilot-scale bioventing, and remained low at the 1-year sampling event. BTEX concentrations in soils at HVW-2 and MPA decreased 3 to 4 orders of magnitude to nondetect levels as a result of SVE and air injection bioventing. Lesser decreases in BTEX soil concentrations were evident at MPC.

Soil samples also were collected from MPE, MPF, and compliance monitoring well CW2 (Figure 2.7) in July 1995 during bioventing system expansion. TRPH and BTEX concentrations in soils collected from MPE and MPF indicated these areas were moderately impacted by fuel hydrocarbon contamination. Significant contamination



was not evident at CW2. Although no soil sampling was performed by Parsons ES following 1 year of full-scale system operation, based on measured reductions in soil gas TVH and BTEX concentrations and decreased *in situ* respiration rates, significant reductions in soil TRPH and BTEX concentrations appear to have occurred as the result of expanded-scale bioventing system operation.

2.4.2 Soil Gas Sampling Results

Soil gas sampling was performed in March 1993 prior to SVE/bioventing system startup (in October 1993), in December 1994 following 3 months of SVE and 9 months of air injection bioventing system operation, in July 1995 prior to expanded-scale bioventing system startup, and in November 1996 following 15 months of expanded-scale bioventing system operation. Soil gas samples were collected from each MP and field-screened to assess soil gas concentrations of oxygen, carbon dioxide, and TVH. Results presented in Table 2.3 indicate that static oxygen concentrations in soil gas have generally increased with continued bioventing at the site. During the November 1996 sampling event, soils at MPF had not experienced a measurable increase in soil gas oxygen concentration, which suggested ongoing aerobic activity associated with relatively greater residual hydrocarbon contamination (Table 2.2).

Initial, 1-year, and 3-year soil gas samples also were collected at selected locations for laboratory analysis (Table 2.3). For all three sampling events, samples were sent to the Air Toxics, Ltd. laboratory in Folsom, California and analyzed for TVH and BTEX using USEPA Method TO-3. Comparison of 1-year and 3-year soil gas results demonstrated substantial reductions in TVH and BTEX concentrations compared to initial values. With the exception of total xylenes at MPE, BTEX concentrations had been reduced to less than 1.0 ppmv at all locations sampled during the November 1996 sampling event. During the initial 3 years of soil venting system operation, TVH concentrations were reduced from between 38,000 and 100,000 ppmv to less than 1.0 ppmv in the pilot-scale area (MPB and MPC). Soil gas results from MPE and MPF, installed as part of the expanded-scale bioventing system, showed TVH concentrations were reduced between 1 and 3 orders of magnitude following the first year of expanded-scale system operation.

With the exception of results from MPF, located on the east side of the active fiberglass USTs (Figure 2.7), field and analytical soil gas results from the November 1996 sampling event strongly suggested nearly complete remediation of hydrocarbon contaminants in soils at the BX Service Station site. Results of the March 1997 maintenance check demonstrated that MPF was receiving adequate oxygen (20.3 percent) for continued aerobic biodegradation of petroleum hydrocarbon contaminants in this source area (Parsons ES, 1997b).

2.4.3 Respiration Test Results

Respiration and fuel biodegradation rates for the first 3 years of soil venting are shown in Table 2.4. During each testing period, observed rates of oxygen utilization (in situ respiration) were used to estimate aerobic fuel biodegradation rates in site soils. Results of the November 1996 Option 1 testing event demonstrated that in situ respiration and fuel biodegradation rates have generally decreased with continued

SOIL GAS FIELD AND ANALYTICAL RESULTS
BX SERVICE STATION PATRICK AFB, FLORIDA TABLE 2.3 SITE ST-29

Carbon C				Field Screening Data	ata		×	Analytical Data		
Event (percent) (percent) (ppmv) (ppmmv) (ppmmv) (ppmmv) (ppmmv) (ppmmv) (ppmmv) (ppmmv) (ppmmv) (ppmmv)	Sampling	Sampling		Carbon Dioxide		TVH	Benzene	Toluene	Ethylbenzene	Xvlenes
CALE BIOVENTING SYSTEM AREA Initial (393) 1-Year (1294) 1-Year (1295) 1-Year (1295) 1-Year (1296) 1-Year	Location*	Event	(percent)	(percent)	(Amdd)	(bbmv)	(bbmv)	(ppmv)	(bpmv)	(ppmv)
Hinital (1993)	PILOT-SCALE BI	OVENTING SYSTEM A	REA							
1-Year (11294)	HVW-4"	Initial (3/93)	0.0	15.0	> 20,000	47,000	< 2.26	15	4	200
1-Year (11/94)		1-Year (12/94)	ا و	i	1	ı	i	i	1	1
Initial (3/93) 0.0 14.3 > 20,000 100,000 1.5 Year (12/94) 11.8 5.0 230 6.9 3.5 Year (12/94) 11.0 5.1 156 Initial (3/93) 0.0 13.6 > 20,000 1.5 Year (12/94) 3.5 9.8 \$500 1.5 Year (12/94) 4.2 7.8 \$50 1.5 Year (12/94) 14.2 4.2 20,000 38,000 1.5 Year (12/94) 14.2 4.2 20,000 1.7 1.5 Year (12/94) 14.2 4.2 20,000 1.7 1.5 Year (12/94) 11.3 6.0 40 1.5 Year (12/94) 1.1 2.0 1.5 Year (12/94) 1.1 2.0 1.5 Year (11/96) 1.9 1.7 9.2 1.5 Year (11/96) 1.9 1.7 9.2 1.5 Year (11/96) 1.5 8.2 6.0 1.9 9.9 1.5 Year (11/96) 1.5 8.2 6.0 1.0 1.5 Year (11/96) 1.5 8.2 8.0 1.0 1.5 Year (11/96) 1.7 8.8 1.0 1.5 Year (11/96) 1.7 9.8 8.0 0.0 1.7 1.0 1.5 Year (11/96) 1.7 9.8 1.0 1.5 Year (11/96) 1.7 9.8 1.0 1.5 Year (11/96) 1.7 9.8 1.0 1.5 Year (11/96) 1.7 9.8 1.0 1.5 Year (11/96) 1.7 9.8 1.0 1.5 Year (11/96) 1.7 9.8 1.0 1.5 Year (11/96) 1.7 9.8 1.0 1.5 Year (11/96) 1.7 9.8 1.0 1.5 Year (11/96) 1.7 9.8 0.0 0.7 3.5 1.5 Year (11/96) 1.7 1.5 Year (11/96) 1.7		3-Year (11/96)	}	I	1	i	l	I	i	•
1-Year (1294) 118 50 230 69 3-Year (1795) 110 48 50 50 3-Year (1794) 113 51 156 50 1-Year (1794) 135 98 560 54 1-Year (1794) 142 78 56 340 0.17 1-Year (1794) 142 42 200 1.7 1-Year (1794) 143 60 40 1.7 1-Year (1794) 125 50 164 0.13 1-Year (1794) 125 50 164 0.13 1-Year (1794) 12 11 20 50 1-Year (1795) 19 11 20 50 1-Year (1196) 19 175 520,000 27,140 1-Year (1196) 189 16 10 10 1-Year (1196) 189 16 10 10 1-Year (1196) 176 175 20 20 1-Year (1196) 176 17 36 10 1-Year (1196) 17 17 17 36 10 1-Year (1196) 17 17 17 17 17 1-Year (1196) 17 17 17 17 1-Year (1	MPA-3.5	Initial (3/93)	0.0	14.3	> 20.000	100.000	< 53	910	46	011
1.5.Year (7/95) 110 4.8 50		1-Year (12/94)	11.8	5.0	230	6.9	0.033	0.003	0 008	0.46
1.		1.5-Year (7/95)	11.0	89.	S	i	!!	1	1	}
Initial (1994)		3-Year (11/96)	10.7	5.1	951	!	1	ł	!	1
1-Year (1294) 3.5 9.8 560	MPB-3.5	Initial (3/93)	0.0	13.6	> 20,000	ı	i	1	I	!
1.5.Year (1795)		1-Year (12/94)	3.5	8.6	260	I	i	i	i	1
3-Year (11/96) 7.5 6.6 340 0.17 Initial (3/93) 0.0 15.2 >20,000 38,000 1Year (12/94) 14.2 4.2 200 1.7 3-Year (11/96) 12.5 5.0 164 0.13 Initial (3/93) 15.9 2.8 260 1Year (11/96) 19.0 1.7 20 1Year (11/96) 19.0 1.7 20 Initial (7/95) 8.2 6.0 19.6 9.9 Initial (7/95) 15.8 4.0 10 Initial (7/95) 19.8 8.0 20 2.200 Initial (7/95) 19.8 8.0 20 Initial (7/95) 19.5 9.8 8.0 1.6 8.0 Initial (7/95) 19.5 0.0 1.7 Initial (7/95) 19.5 0.0 1.7 Initial (7/95) 19.5 0.0 1.7 Initial (7/95) 19.5 0.0 2.0 Initial (7/95) 19.5 0.0 2.2 Initial (7/95) 19.5 0.0 1.7 Initial (7/95) 19.5 0.0 2.0 Initial (7/95		1.5-Year (7/95)	4.2	7.8	S	1	I	:	:	1
Initial (1994) 142 > 20,000 38,000 1.7 200 1.7 200 1.7 200 1.7 200 1.7 200 1.7 200 1.7 200 1.7 200 1.7 200 1.7 200 1.7 200 1.7 200 2.1 200 2.1 200 2.1 200 2.1 200 2.1 200 2.2 200 2.2 200 2.2 200 2.2 200 2.2 200 2.2 200 2.2 200 2.2 200 2.2 200 2.2 200 2.2 200 2.2 200 2.2		3-Year (11/96)	7.5	9.9	340	0.17	< 0.002	< 0.002	< 0.002	< 0.002
1-Year (1294) 14.2 4.2 200 1.7 1-S-Year (7795) 11.3 6.0 4.0 1-S-Year (7194) 12.5 5.0 164 0.13 1-Year (1294) 1-S-Year (71294) 1-S-Year (71295) 1-S-Year (71295) 1-S-Year (71295) 1-S-Year (71295) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71295) 1-S-Year (71294) 1-S-Year (71295) 1-S-Year (71295) 1-S-Year (71295) 1-S-Year (71295) 1-S-Year (71294) 1-S-Year (71295) 1-S-Year (71295) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) 1-S-Year (71294) .	MPC-3.5	Initial (3/93)	0.0	15.2	> 20.000	38.000	<2.1	8	12	18
1.5 *Year (1795) 11.3 6.0 4.0 Initial (393) 12.5 5.0 164 0.13 Initial (795) 12.5 2.8 260 IYear (1196) 19.0 1.7 9.2 Initial (795) 19.1 1.1 20 Initial (795) 2.8 2.0 27,140 Initial (795) 2.0 17.5 2.000 Initial (795) 2.0 17.5 2.000 Initial (795) 2.0 17.6 2.0 Initial (795) 2.0 2.0		1-Year (12/94)	14.2	4.2	200	1.7	0.02	< 0.002	< 0.002	< 0.002
3-Year (11/96) 12.5 5.0 164 0.13 linitial (3/93) 15.9 2.8 260 1-Year (12/94) 1.5-Year (17/95) 19.1 1.1 20 3-Year (17/95) 19.1 1.1 20 ALE BIOVENTING SYSTEM AREA Initial (7/95) 0.0 18.0 19,000 27,140 Initial (7/95) 0.0 17.5 >20,000 27,500 Initial (7/95) 15.8 4.0 10 Initial (7/95) 15.8 8.0 20 Initial (7/95) 19.5 9.8 8.0 20 Initial (7/95) 19.5 0.8 10 Initial (7/95) 2.00 0.7 3.6 Initial (7/95) 2.00 0.7 3.6		1.5-Year (7/95)	11.3	0.9	9	1	I	1	!	1
Initial (1994) 159 28 260 1.5 Year (1294) 3. Year (1294) 3. Year (1294) 4. Sale (1294) 5. Year (1294) 5. Year (1295) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795) Initial (795)		3-Year (11/96)	12.5	5.0	161	0.13	< 0.002	< 0.002	< 0.002	< 0.002
1-Year (12/94)	MPD-3.5	Initial (3/93)	15.9	2.8	260	ı	1	ł	•	1
1.5.Year (7/95) 19.1 1.1 20 3.Year (7/95) 19.0 1.7 92 3.Year (1/96) 19.0 1.7 92 Initial (7/95) 0.0 18.0 19.000 27,140 1.Year (1/96) 0.0 17.5 >20,000 27,300 1.Year (1/96) 15.8 4.0 10 Initial (7/95) 15.8 4.0 10 Initial (7/95) 9.8 8.0 20 Initial (7/95) 19.5 9.8 1.0 Initial (7/95) 19.5 0.8 10 Initial (7/95) 19.5 0.8 10 Initial (7/95) 20.0 0.7 36 Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95)		1-Year (12/94)	i	ı	i	i	1	I	?	1
3-Year (11796) 19.0 1.7 92 ALE BIOVENTING SYSTEM AREA		1.5-Year (7/95)	161		50	ı	į	ł	i	1
ALE BIOVENTING SYSTEM AREA Initial (7/95) 0.0 18.0 19,000 27,140 1-Year (11/96) 0.0 17.5 >20,000 27,500 1-Year (11/96) 0.0 17.5 >20,000 27,500 Initial (7/95) 15.8 4.0 10 Initial (7/95) 9.8 8.0 20 Initial (7/95) 19.5 0.8 10 Initial (7/95) 19.5 0.8 10 Initial (7/95) 2.00 0.7 3.6 Initial (7/95) 2.00 0.7 3.6 Initial (7/95)		3-Year (11/96)	19.0	1.7	92	•	į	i	1	1
Initial (7/95)	FULL-SCALE BIC	OVENTING SYSTEM AR	YEV							
1-Year (11/96) 8.2 6.0 196 9.9 Initial (7/95) 0.0 17.5 >20,000 27,500 1-Year (11/96) 15.8 4.0 10.0 2,200 Initial (7/95) 15.8 4.0 10 Initial (7/95) 9.8 8.0 20 Initial (7/95) 19.5 0.8 10 Initial (7/95) 20.0 0.7 36 Initial (7/95)	MPE-3.5	Initial (7/95)	00	081	19 000	27 140	88	130	976	900
Initial (7/95) 0.0 17.5 >20,000 27,500 1.7 (1/96) 0.0 10.4 1,020 2,200 1.2 (1/96) 1.3 (1/96) 1.3 (1/96) 1.3 (1/96) 1.3 (1/96) 1.4 (1/96) 1.5 (1/96) 1.5 (1/96) 1.7 (1/96) 1.7 (1/96) 1.7 (1/96) 1.7 (1/96) 1.7 (1/96) 1.7 (1/96) 1.9 (1/96) 1.9 (1/96) 1.0 (1		1-Year (11/96)	8.2	0.9	<u>86</u>	6.6	< 0.005	0.11M"	0.24	1.6
1-Year (11/96) 0.0 10.4 1,020 2,200 Initial (7/95) 15.8 4.0 10 1-Year (11/96) 18.9 1.6 80 1-Year (11/96) 17.6 2.0 88 1.0 Initial (7/95) 19.5 0.8 10 Initial (7/95) 2.29 Initial (7/95)	MPF-3.5	Initial (7/95)	0.0	17.5	>20.000	27.500	80	13	S.	010
Initial (7/95) 15.8 4.0 10 1-Year (11/96) 18.9 1.6 80 Initial (7/95) 9.8 8.0 20 Initial (7/95) 17.6 2.0 88 1.0 Initial (7/95) 20.0 0.7 3.6 Initial (7/95) Initial (7/95) Initial (7/95) Initial (7/95) 2.29		1-Year (11/96)	0.0	10.4	1,020	2,200	91.0	0.53	0.39	0.65
1-Year (1196) 18.9 1.6 80 Initial (7/95) 9.8 8.0 20 1-Year (11/96) 17.6 $\frac{1}{1}$, 2.0 88 1.0 Initial (7/95) 19.5 0.8 10 Initial (7/95) 2.29	MPG-3.5	Initial (7/95)	15.8	4.0	01	ı	1	ı	i	I
Initial (7/95) 9.8 8.0 20 1-Vear (11/96) 17.6 ; 2.0 88 1.0 Initial (7/95) 19.5 0.8 10 Initial (7/95) 2.29		1-Year (11/96)	18.9	9.1	80	1	ì	I	1	1
-Vear (11/96) 17.6	MPH-3.5	Initial (7/95)	8.6	8.0	70	!	1	i	i	1
Initial (7/95) 19.5 0.8 10 1-Year (11/96) 20.0 0.7 36 Initial (7/95) 2.29		I-Year (11/96)	9.71	2.0	80	1.0	< 0.002	< 0.002	< 0.002	< 0.002
1-Year (1196) 20.0 0.7 36	MPI-3.5	Initial (7/95)	19.5	9.0	02	ı	**	ı	ŀ	I
Initial (7/95) 2.29		I-Year (11/96)	20.0	0.7	36	1	i	1	ı	1
	CW2-4"	Initial (7/95)	I	I	ł	2.29	< 0.002	0.070	< 0.002	< 0.002
		1-Year (11/96)	1	***	i	i	1	i	;	i

[&]quot;Sampling location identifies the sampled monitoring point and depth in feet below ground surface." TVH = total volatile hydrocarbons.

[&]quot;ppmv = parts per million, volume per volume.

Soil gas analyses performed using USEPA Method TO-3.

^{6 &}gt; = measurement exceeded maximum reading for GasTech® Trace-Techtor Hydrocarbon Analyzer. "The pilot-scale horizontal vent well is designated HVW-2 on Figure 2.7.

 $V < \infty$ analyte concentration was less than the method detection limit shown.

w ... = not analyzed.

^{*} M= laboratory reported value may be biased due to apparent matrix interferences.

* Compliance monitoring well 2 (CW2) is screened from approximately 3 to 13 feet below ground surface. The middle of the effective screened interval for soil gas sampling was approximately 4 feet below ground surface during the 7/95 sampling event

RESPIRATION AND FUEL BIODEGRADATION RATES PATRICK AFB, FLORIDA BX SERVICE STATION TABLE 2.4 SITE ST-29

	Initial (Initial (March 1993)	6-Month (May 1994)	day 1994)*/	1-Year (L	1-Year (Dec. 1994)	3-Year (Nov. 1996)	lov. 1996)
Testing	Respiration Rate	Degradation Rate	Respiration Rate	Degradation Rate	Respiration Rate	Degradation Rate	Respiration Rate	Degradation Rate
Location-Depth	(% O ₂ /hour)	(mg/kg/year)"	(% O ₂ /hour)	(mg/kg/year)	(% O ₂ /hour)	(mg/kg/year)	(% O ₂ /hour)	(mg/kg/year)
MPA-3.5	0.17	940	0.19	970	0.029	130	NMe	NC
MPB-3.5	0.15	840	0.27	1,400	0.035	150	0.084	380
MPC-3.5	0.16	970	0.16	850	0.020	92	MN	NC
MPE-3.5	/8	•					9900	290
MPF-3.5		ł		-	8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	•	0.12	540

Initial bioventing pilot test occurred in March 1993, but SVE/air injection bioventing system operation did not begin until October 18, 1993.

Willigrams of hydrocarbons per kilogram of soil per year.

6 6-month degradation rates based on average soil moisture results for initial and 1-year soil sampling events.

[&]quot;3-year degradation rates based on average soil moisture result from December 1994 soil sampling event.

NM = not measured.

[&]quot; NC = not calculated.

^{* ---- =} not analyzed; MPE and MPF were not installed until July 1995.

bioventing at the site. Respiration and fuel biodegradation rates at MPF were somewhat elevated during the Option 1 testing event due to the remaining hydrocarbon contamination present at this location.

2.4.4 Recommendations Following Option 1 Testing

Because of the relatively high TVH concentrations in soil gas at MPF, Parsons ES recommended continued expanded-scale bioventing system operation at the site for an additional 6 months to 1 year prior to initiating Option 2 confirmation sampling activities. Based on soil sampling results and soil gas and respiration results obtained following approximately 3 years of SVE and pilot- and expanded-scale bioventing system operation, the majority of the soils at the site are likely to have been sufficiently remediated to meet FDEP (1997) criteria outlined in FAC, Chapter 62-770. Continued operation of the expanded-scale bioventing system since November 1996 has further reduced petroleum hydrocarbon contamination in site soils, including soils near MPF. It is anticipated that soil analytical results will meet FDEP risk-based criteria for NFA, or groundwater monitoring only, and no further soil remediation will be necessary.

2.5 NATURAL ATTENUATION UPDATE SAMPLING

In March 1998, personnel from NRMRL performed an additional round of groundwater sampling at Site ST-29 to evaluate the progression of dissolved fuel contaminant natural attenuation. At the time this SAP was prepared, monitoring results from this sampling event were not available. These groundwater sampling results will be provided in a separate report generated as part of the AFCEE natural attenuation project.

SITE CLEANUP REQUIREMENTS

3.1 SITE CHARACTERIZATION REQUIREMENTS

The objective of the confirmation sampling is to demonstrate that contaminant levels in soils contaminated by previous leaks of MOGAS from the fiberglass fuel line and UST located near the active fuel facilities west and southwest of Building 736 meet FDEP (1997) risk-based criteria for NFA, or groundwater monitoring only, and that no further soil remediation will be necessary. This SAP targets unsaturated and smearzone soils in the immediate vicinity of, and downgradient from, the active BX Service Station pump islands and USTs.

3.2 CLEANUP CRITERIA

This section describes Florida's closure approach for sites contaminated with petroleum products. The final draft *Petroleum Contamination Site Cleanup Criteria* rule (Chapter 62-770, FAC) (FDEP, 1997) presents guidance for determination of remedial requirements for closure of petroleum-contaminated sites, including several mechanisms for determining matrix-specific cleanup criteria. The regulations allow closure of petroleum release sites under several different scenarios, including:

- NFA Proposal Without Conditions,
- NFA Proposal With Conditions, or
- Monitoring-Only Proposal for Natural Attenuation.

Closure of a site under the NFA-Without-Conditions alternative would allow unrestricted future use of the site (e.g., residential land use), and therefore the requirements and allowable contaminant levels under this alternative are the most restrictive. The NFA-With-Conditions alternative requires that appropriate institutional or engineering controls be implemented to limit receptor exposure to contaminated media; sites seeking closure under this alternative are subject to potentially less stringent cleanup levels. A natural attenuation monitoring program is a recognized means of remediating sites with petroleum hydrocarbon contamination in groundwater, with the goal of achieving the NFA target cleanup levels.

3.2.1 No Further Action Without Conditions

Closure of a petroleum release site under an NFA Proposal without conditions requires that a site meet the following criteria:

- No mobile LNAPL (free-phase product) is present;
- No fire or explosion hazard is present due to release of petroleum or petroleum products;
- No "excessively contaminated soil" is present; and
- Matrix-specific target cleanup levels (for soil and groundwater) are met.

Contaminant concentrations in all affected media at a site must be below all applicable target cleanup levels for the site to qualify for a NFA without conditions proposal. The *Petroleum Contamination Site Cleanup Criteria* rule (FDEP, 1997) incorporates matrix-specific target cleanup levels for petroleum constituents in the form of "look-up" tables or through reference to other applicable regulations (i.e., state groundwater or surface water regulations).

To demonstrate that contaminated soil is not present in the unsaturated zone, representative soil samples must show that concentrations of the applicable petroleum products' chemicals of concern are less FDEP (1997) direct human exposure and leachability target levels. If leachability target cleanup levels are exceeded, direct leachability testing can be performed to determine if leachate concentrations exceed the applicable groundwater target cleanup levels. In addition, the rule also allows for the development of alternative cleanup standards that can be used in place of those presented in the look-up tables. The alternative cleanup standards must be developed based on site-specific exposure scenarios and risk assessment.

3.2.2 No Further Action With Conditions

Closure of a petroleum release site under an NFA Proposal with conditions requires that a site meet the first three criteria for NFA without conditions (Section 3.2.1); however, alternative target cleanup levels may be justified by the property owner by agreeing to the enactment of institutional controls (i.e., land use restrictions) and/or engineering controls. For soil, less restrictive direct-exposure target cleanup levels may be used, and leachability target cleanup levels may be exceeded if it can be demonstrated based on site characteristics and restrictions specified in the institutional control, that petroleum product chemicals of concern will not leach into groundwater at concentrations exceeding applicable groundwater target cleanup levels. For groundwater, alternative groundwater target cleanup levels may be justified depending on the current and projected use of groundwater in the vicinity and by enacting appropriate institutional controls.

3.2.3 Natural Attenuation With Monitoring

The FDEP recognizes natural attenuation with monitoring as a viable site rehabilitation strategy for petroleum-contaminated groundwater. The following criteria must be met to demonstrate that this strategy is appropriate for a site:

• No mobile LNAPL is present;

- Contaminated soil is not present or does not constitute a continuing source of contamination to groundwater;
- Groundwater contaminant concentrations above applicable target cleanup levels are not migrating beyond a temporary POC;
- · Available data show an overall decrease in the mass of contamination; and
- Contaminant concentrations in groundwater do not exceed appropriate criteria (Table IX levels, Chapter 62-770, FAC); or technical evaluations (as specified in Chapter 62-770.690 (1)(f), FAC) indicate that natural attenuation is an appropriate remedial alternative.

Natural attenuation with monitoring requires the establishment of a temporary POC based on site-specific conditions relating to land and groundwater use, potentially exposed populations, hydrogeology, and type and concentrations of contaminants. If human health, public safety, and the environment are protected, the POC may be moved to the property boundary, or beyond the property boundary (with notice), if necessary to address current plume conditions.

3.3 CLEANUP STANDARDS FOR THE BX SERVICE STATION, SITE ST-29

Based on previous soil sampling results and soil gas and respiration results obtained following approximately 3 years of SVE and pilot- and expanded-scale bioventing system operation, the majority of the soils at the site are likely to have been sufficiently remediated to meet FDEP (1997) criteria outlined in Chapter 62-770. Continued operation of the expanded-scale bioventing system since November 1996 has further reduced petroleum hydrocarbon contamination in site soils including soils near MPF. It is anticipated that the concentration of residual MOGAS chemicals of potential concern (COPCs) in unsaturated and smear zone soils in the vicinity of the active dispensing islands and USTs at the BX Service Station are less than the applicable FDEP target cleanup levels for NFA and no further soil remediation will be necessary.

3.3.1 Soil Criteria

Confirmation soil sample results will be compared to target cleanup levels established by FDEP (1997) to demonstrate that petroleum hydrocarbon contaminants in site soils have been sufficiently remediated to meet the requirements for a NFA proposal. Specifically, direct-exposure and leachability target cleanup levels from Table IV (FDEP, 1997) will be used as the initial cleanup criteria. Confirmation soil sampling results will be compared to the residential and industrial direct-exposure levels and leachability target levels for groundwater resource protection and recovery (because shallow groundwater at the site is not likely to impact surface water in the vicinity of Patrick AFB).

Table 3.1 compares the maximum detected site soil concentrations of petroleum hydrocarbon contaminants to the proposed FDEP target cleanup levels. As is evident from this comparison, pre-bioventing concentrations of benzene, ethylbenzene, xylenes and TRPH in soil were not in compliance with FDEP (1997) direct-exposure or

TABLE 3.1 COMPARISON OF MAXIMUM SITE SOIL CONCENTRATIONS TO TARGET CLEANUP LEVELS

BX SERVICE STATION SITE ST-29 PATRICK AFB, FLORIDA

		Maximum	Location of	Sample	FDEP	Target Clea	anup Levels 2
		Concentration	Maximum	Collection	Direct E	xposure b/	Soil
Chemical Name	Units	Detected	Detection	Date	I	П	Leachability c/
TRPH d/	mg/kg e/	2,730	HVW-2	Mar-93	350	2,500	340
Benzene	mg/kg	6.99	CPT-02-A19	Mar-94	1.1	1.50	0.007
Ethylbenzene	mg/kg	260	HVW-2	Mar-93	240	240	0.4
Toluene	mg/kg	54	HVW-2	Mar-93	300	2,000	0.4
Xylenes	mg/kg	2,600	HVW-2	Маг-93	290	290	0.3
Acenaphthene	mg/kg	ND f/	NA g/	Oct-93	2,300	22,000	4
Acenaphthylene	mg/kg	ND	NA	Oct-93	1,100	11,000	22
Anthracene	mg/kg	ND	NA	Oct-93	19,000	290,000	2,000
Benzo(a)anthracene	mg/kg	ND	NA	Oct-93	1.4	5.1	2.9
Benzo(a)pyrene	mg/kg	ND	NA	Oct-93	0.1	0.5	7.8
Benzo(b)fluoranthene	mg/kg	ND	NA	Oct-93	1.4	5	9.8
Benzo (g,h,i)perylene	mg/kg	ND	NA	Oct-93	2,300	45,000	13,000
Benzo(k)fluoranthene	mg/kg	ND	NA	Oct-93	15	52	25
Chrysene	mg/kg	ND	NA	Oct-93	140	490	80
Dibenzo(a,h)anthracene	mg/kg	ND	NA	Oct-93	0.1	0.5	14
Fluoranthene	mg/kg	0.20J h/	SB-10	Oct-93	2,800	45,000	550
Fluorene	mg/kg	ND	NA	Oct-93	2,100	24,000	87
Indeno(1,2,3-cd)pyrene	mg/kg	ND	NA	Oct-93	1.5	5.2	28
Naphthalene	mg/kg	60	SB-15	Oct-93	1,000	8,600	The same of the sa
Phenanthrene	mg/kg	0.12J	SB-10	Oct-93	1,900	29,000	120
Pyrene	mg/kg	0.14J	SB-10	Oct-93	2,200	40,000	570
MTBE i/	mg/kg	NR ^{j/}	NA	NA	350	6,100	0.2
Lead	mg/kg	15.3	SB-6	1990	500	1,000	100/TCLP k/

Notes: Shading indicates maximum site concentration above target cleanup level indicated.

^a FDEP, 1997.

^{b'} Direct Exposure I and II are for No Further Action Without or With Conditions.

Based on Table V (Groundwater Cleanup Target Levels).

TRPH = total recoverable petroleum hydrocarbons. Maximum concentration based on analysis by USEPA Method 418.1; total petroleum hydrocarbons (TPH) concentrations from March 1994 not considered. Target cleanup levels based on State of Florida FL-PRO analysis.

^ε mg/kg = milligrams per kilogram.

⁹ ND = not detected; laboratory reporting limit not available.

^{g/} NA = not applicable.

 $^{^{\}text{N}}$ J = analyte detected below laboratory reporting limit; the value shown represents a laboratory estimated concentration.

WTBE = methyl tert-butyl ether.

y NR = no results available.

If total lead concentration exceeds 100 mg/kg when analyzed by USEPA SW7421, then sample must pass Toxicity Characteristic Leaching Procedure (TCLP) criterion of 5.0 mg/L for total lead.

leachability target cleanup levels. However, it is anticipated that representative confirmation soil sample results will demonstrate that the concentration of these contaminants in soil following approximately 4.5 years of soil venting treatment now are below the prescribed levels.

3.3.2 Alternative Cleanup Standards

For those contaminants exceeding target cleanup levels for NFA (With or Without Conditions), alternative cleanup standards for soil contaminated with petroleum products may be developed based on a site-specific risk assessment. Development of alternative standards for those chemicals that are below the more stringent levels provided in the Rule should not be necessary.

If performed, the risk assessment would include a site-specific exposure assessment based on:

- Chemical concentrations in all contaminated media;
- · Soil properties;
- Potential exposure pathways and routes;
- Current or potential future exposed populations;
- Exposure factors (i.e., exposure duration and frequency); and
- Expected contaminant concentrations to which actual or potential receptors may be exposed.

In establishing alternative target cleanup levels, the following factors would be used, as appropriate:

- Calculations using a lifetime cancer risk level of 1.0 x 10⁻⁶ for carcinogenic COPCs;
- A hazard index of 1 or less for noncarcinogenic COPCs;
- Best achievable detection limits;
- Naturally occurring background concentrations (for inorganics); and/or
- Nuisance, organoleptic, or aesthetic considerations.

These alternative site-specific target cleanup levels, if developed, would be used for closure under an NFA With Conditions proposal.

SITE CONFIRMATION SOIL AND GROUNDWATER SAMPLING AND ANALYSIS PLAN

The following SAP describes the borehole locations, sampling depths, soil sampling procedures, and analytical methods proposed to collect sufficient data to verify remediation of petroleum hydrocarbon contaminants in vadose and smear zone soils at the BX Service Station to proposed cleanup levels (Table 3.1).

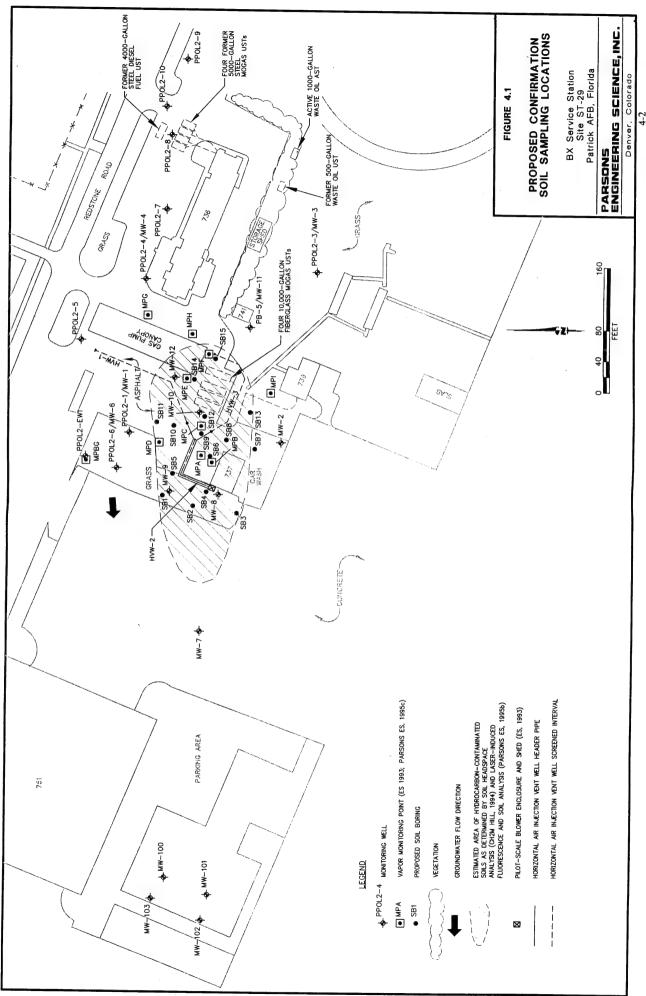
4.1 SOIL SAMPLING

This section describes the scope of work required for collecting confirmation soil samples at the BX Service Station. An estimated 15 boreholes will be drilled and sampled in the vicinity of the active fueling facilities in the area previously shown to contain elevated hydrocarbon concentrations in saturated and unsaturated zone soils (Figure 2.6). A maximum of two additional boreholes may be drilled and sampled if field screening results indicate significant contamination extending beyond the proposed sampling area. Proposed borehole locations are shown on Figure 4.1.

One month prior to soil sampling, the expanded-scale bioventing system at the BX Service Station will be shut down to allow subsurface conditions to return to equilibrium. Soil sampling will be conducted by qualified Parsons ES scientists and technicians trained in the conduct of soil sampling, records documentation, and environmental sample chain-of-custody procedures. In order to provide complete documentation of the sampling event, detailed records will be maintained by the Parsons ES field hydrogeologist. In addition, sampling personnel will have thoroughly reviewed this SAP prior to sample collection and will have a copy available onsite for reference.

4.1.1 Drilling, Sampling, and Equipment Decontamination

Soil boreholes will be advanced to the groundwater table surface (approximately 4 to 6 feet bgs) with a hand auger. Undisturbed soil samples, suitable for chemical analysis, will be obtained from each borehole by collecting the required volume of soil directly from the hand-auger bucket. Soil types will be classified according to the Unified Soil Classification System (USCS) and described in accordance with the standard Parsons ES soil description format. All soil samples will be visually examined, and sample headspace will be field screened for VOCs using a photoionization detector (PID) or a TVH analyzer (TVHA). The data obtained from the logging and screening will be recorded on borehole logs.



Based on field screening results, one sample with the greatest apparent petroleum hydrocarbon contamination from each boring will be selected and submitted for laboratory analysis using laboratory-prepared containers. Samples selected for laboratory analysis will be labeled with the site name and borehole number, sample depth, date of collection, project name, and other pertinent data. The sample containers will be sealed in plastic bags and immediately placed in an insulated cooler containing ice. The soil samples will be maintained in a chilled condition until delivered to the analytical laboratory. Chain-of-custody records will be prepared in the field and will accompany the samples to the analytical laboratory.

Augers and other downhole equipment will be cleaned before use and between boreholes to prevent cross-contamination. Between sampling events, the hand-auger bucket will be cleaned with Alconox® detergent, followed by successive potable and distilled water rinses. Decontamination water and auger cuttings will be managed as described in Section 4.4. Boreholes will be abandoned using bentonite following drilling and sampling. Boreholes drilled through asphalt will be repaired at the surface using asphalt cold-patch.

4.1.2 Soil Sample Analyses

Proposed soil sample analytical methods, estimated number of samples, and reporting limits are presented in Table 4.1. All samples will be analyzed by a State of Florida-certified and AFCEE-approved laboratory. Parsons ES proposes to analyze samples from the BX Service Station for TRPH by State of Florida Method FL-PRO; for BTEX using USEPA Method SW8020; and for PAHs using USEPA Method SW8310. Quality control (QC) samples also will be analyzed to assess laboratory methods. The laboratory will perform analyses on one matrix spike, one laboratory control sample, and one laboratory blank for each specific analytical method requested. Field QC samples will be collected and analyzed as described in Section 4.3.

4.2 CHAIN-OF-CUSTODY CONTROL

After the samples for laboratory analysis have been collected, chain-of-custody procedures will be followed to establish a written record of sample handling and movement between the sampling site and the laboratory. Samples collected for onsite field analyses will not require chain-of-custody records. Each shipping container will have a chain-of-custody form completed in triplicate by the sampling personnel. One copy of this form will be kept by the sampling contractor after sample delivery to the analytical laboratory, and the other two copies will be submitted to the laboratory with the samples. One of the laboratory copies will become a part of the permanent record for the sample and will be returned to Parsons ES with the sample analytical results. The chain-of-custody will contain the following information:

- Site name and address;
- Sample identification number:
- Sample collector's printed name and signature;

TABLE 4.1 PROPOSED SOIL SAMPLE ANALYTICAL METHODS, REPORTING LIMITS, AND NUMBER OF SAMPLES

BX SERVICE STATION

SITE ST-29

PATRICK AFB, FLORIDA

				Field or
	Number of	Reporting		Fixed-Base
nalytical Method	Samples ^{a/}	Limitb	Units ^{c/}	Laboratory
State of Florida FL-PRO				
TRPH ^{d'}	15	TBD ^{e/}	mg/kg	Fixed-base
USEPA Method SW8020				
Benzene	15	1.0	μg/kg	Fixed-base
Toluene	15	2.0	μg/kg	Fixed-base
Ethylbenzene	15	2.0	μg/kg	Fixed-base
Xylenes	15	2.0	μg/kg	Fixed-base
MTBE ⁰	15	1.0	μg/kg	Fixed-base
USEPA Method SW8310	·			
Acenapthene	15	1,200	μg/kg	Fixed-base
Acenaphthylene	15	1,540	μg/kg	Fixed-base
Anthracene	15	440	μg/kg	Fixed-base
Benzo(a)anthracene	15	9	μg/kg	Fixed-base
Benzo(a)pyrene	15	15	μg/kg	Fixed-base
Benzo(a)fluoranthene	15	12	μg/kg	Fixed-base
Benzo(g,h,i)perylene	15	50	μg/kg	Fixed-base
Benzo(k)fluoranthene	15	11	μg/kg	Fixed-base
Chrysene	15	100	μg/kg	Fixed-base
Dibenzo(a,h)anthracene	15	20	μg/kg	Fixed-base
Fluoranthene	15	140	μg/kg	Fixed-base
Fluorene	15	140	μg/kg	Fixed-base
Indeno(1,2,3-cd)pyrene	15	30	μg/kg	Fixed-base
Naphthalene	15	1,200	μg/kg	Fixed-base
Phenanthrene	15	420	μg/kg	Fixed-base
Pyrene	15	180	μg/kg	Fixed-base

Excludes QC samples. If optional boreholes are required, one additional soil sample per optional borehole also will be collected and analyzed.

^b Project reporting limit as specified in subcontract for analytical services.

 $^{^{\}text{c}\prime}$ mg/kg = milligrams per kilogram; µg/kg = micrograms per kilogram.

 $^{^{}d'}$ TRPH = total recoverable petroleum hydrocarbons.

e' TBD = to be determined.

 $^{^{0}}$ MTBE = methyl tert-butyl ether.

- Date and time of collection;
- Place and address of collection;
- Type of sample (i.e. composite, grab, etc.);
- Sample matrix (soil or groundwater);
- · Chemical preservatives added;
- Analytical laboratory to be utilized;
- Analyses requested;
- Signatures of individuals involved in the chain of possession; and
- Inclusive dates of possession.

The chain-of-custody documentation will be placed inside the shipping container so that it will be immediately apparent to the laboratory personnel receiving the container, but will not be damaged or lost during transport. The shipping container will be sealed so that it will be obvious if the seal has been tampered with or broken.

4.3 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Samples must be collected, preserved, transported, and analyzed in such a manner that sampling results yield information that provides a reliable representation of the soil and groundwater quality at the site. To meet this requirement, the procedures described in Sections 4.1 will be followed during sample collection, handling, and analysis. In addition, laboratory QC samples will be analyzed as described in Sections 4.1.2.

Field quality assurance will include collection of field replicates, rinseate blanks, and trip blanks. Soil QC sampling will include two replicates (minimum frequency of 10 percent), one rinseate blank, and one trip blank for each cooler with samples designated for BTEX analysis.

4.4 MANAGEMENT OF INVESTIGATION-DERIVED WASTES

Soil cuttings generated during hand-auger soil sampling will be minimal. Residual cuttings not prepared for laboratory analysis will be returned to their respective soil borehole prior to plugging the borehole with bentonite. Equipment decontamination and rinseate water will be accumulated, transferred to a truck-mounted tank, and transported to the Trident STP (an industrial wastewater treatment plant) at Cape Canaveral Air Station (AS) for discharge and treatment. The site name, source location, volume, date of collection, and other pertinent information will be recorded in the Cape Canaveral AS investigation-derived waste inventory maintained by Parsons ES.

SITE CONFIRMATION SAMPLING REPORT FORMAT

Following receipt and evaluation of the laboratory analytical results, a draft confirmation soil sampling report will be prepared. The report will summarize soil analytical results from the confirmation sampling event in order to demonstrate source removal and support recommendations for NFA (i.e., no further soil remediation), if appropriate. The confirmation sampling report and recommendations will be submitted to FDEP, Patrick AFB, and AFCEE.

As a minimum, the report will contain the following information for the BX Service Station:

- This confirmation SAP (as an appendix);
- Site plot plan showing sampling locations;
- · Summary of field activities;
- Assessment of soil analytical results in comparison to applicable FDEP (1997) target cleanup levels (Tables 3.1);
- Laboratory analytical reports and chain-of-custody forms;
- Borehole logs;
- FDEP (1997) required information, conclusions, and recommendations for NFA (Chapter 62-770.680, FAC), natural attenuation and monitoring-only (Chapter 62-770.690, FAC), or additional active remediation (Chapter 62-770.700, FAC) or monitoring (Chapter 62-770. 750., FAC), as appropriate, based on available analytical results.

PATRICK AFB SUPPORT REQUIREMENTS

The following Patrick AFB support is needed prior to the arrival of the Parsons ES team:

- Assistance in obtaining digging permits,
- · Arrangement of site access for Parsons ES, and
- Assistance in handling/disposal of decontamination/rinseate waters in accordance with Section 4.4.

PROJECT SCHEDULE

The following schedule is contingent upon timely approval of this confirmation SAP and fulfillment of the Patrick AFB support requirements outlined in Section 6.

Event	Date
Submit Draft Confirmation SAP to AFCEE and Patrick AFB	29 April 1998
Receipt of AFCEE and Patrick AFB Comments	29 May 1998
Submit Final SAP to AFCEE, Patrick AFB, and FDEP*	June 1998
Confirmation Sampling	July 1998
Submit Draft Confirmation Sampling Report to AFCEE and Patrick AFB	October 1998
Receipt of AFCEE and Patrick AFB Comments	November 1998
Submit Draft Final Confirmation Sampling Report to AFCEE, Patrick AFB, and FDEP	December 1998

^{*} FDEP review and comment on the SAP occurred during the 17 April 1998 Petroleum Action Management Plan (PAMP) Meeting.

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APPENDIX A BX SERVICE STATION (SITE ST-29) GROUNDWATER DATA

APPENDIX A-1 GROUNDWATER DATA FROM OB&G, 1994 AND 1995

USAF - 45th Space Wing Contamination Assessment Report ST-29 (PPOL-2) Revision: 0 November 9, 1994 Table 1-1

TABLE 1-1 - ST-29 (PPOL-2) PREVIOUSLY DETECTED COMPOUNDS PHASE II, STAGE 2, ROUND 1 AND 2 GROUND WATER

							ı					
	WELL	WELL PPOL2-1	WELL P	WELL PPOL2-2	MELL .	WELL PPOL2:3	WELL PPOL2-4	POL2-4	WELL P	WELL PPOL2-5	WELL PPOL2-8	OL2-8
Parameters Units	Stage 2 Round 1	Stage 2 Round 2										
Petroleum Hydrocarbons mg/L	0.6	-	-	•	1	t	١	-	ı		:	١.
Lead, total mg/L	0.0025	0.0101	1	0.0039	0.0070	0.0221	0.0017	0.0027	0.0033	0.0095	1	
Lead, dissolved mg/L	1	1		-	1	0.0028	ı	0.0014	1	1	1	١.
Bromodichloromethane µg/L	:		1	_	-	1	1	3.10	1	-	1	1
Chloroform	-		1	1	í	1	-	6.63	-	ı	ı	1
Chloromethane µg/L.	1	1	669.0	-	QN	-	1	•	1	1	ı	1
Trans-1,2-dichloroethens	1	0.31	ı	1	1	-	1	ſ	ı	0.65	١	1
Methylene Chloride	1	1	,	ı	-	ı	ı	ON	1	ı	١	1
Trichloroeithene	ı	0.702	1	1	-	-	-		1	ı	l	ı
Chlorobenzene µg/L	0.387	1	1	-	ı	•	-		,	1	1	1
Toluene	0.85	ı	1	1	1	1	0.72	ı	1		ı	ı
Xylenes, total	1.56	ı	1	1	1	ı	1.62	-	1	١	1	,
Methyl-T-butylether µp/L	151	QV	0.910	ı	1	I	13.3	-	1	QN	ł	ı
Bis(2-ethythexyi) phthalate	NRO	•	NRQ	ı	NRO	. 1	NRO	1	NRQ	1.	NRQ	4.2

current concentration less than instrument detection limit Not Detected Not Detected Not Requested

ND ...

KEY:

ESE, 1991. Source:

USAF - 45th Space Wing Contamination Assessment Report ST-29 (PPOL-2) Revision: 0 November 9, 1994 Table 2-6 (Page 1 of 5)

	1	OD SW-841	R010/802	101											
VOLATILE ORGANICS (USEPA METHOD SW-848 8010/8020)	TA MELL			2											
Benzena	ng/L	9	Q	9	2	Q	2	v	က	46	Q	9	2	QV	S
Benzyl chloride	ug/L	2	QŅ	Q	QN	QN	Q	9	Q	QN	QN	Q	¥	Q	ž
Bromabenzena	7/Bn	2	2	2	9	2	9	2	2	2	2	2	2	Q	2
Bromodichloromethane	ng/L	Q	Q	Q	QN	2	Q	N Q	Q	Q	QN	QN	QN	Q	2
Вготогот	7/Bn	2	QN	2	9	2	2	9	2	2	2	2	2	Q	2
Bromomethane	ug/L	Q.	Q	ð	QN	2	₽.	Q	QN	9	Q	QN	9	QN	S
Carbon tetrachloride	ng/L	QV	2	2	Q	2	2	Q	2	2	2	2	9	Q	2
Chlorobenzene	ng/L	QN	QN	QN	QN	Q	2	Q	ND	9	Q	Q	Q	QN	2
Chloroethane	ug/L	Q	2	9	9	2	2	2	2	2	9	Q	2	2	2
Chloroform	ng/L	QN	Q	Q	Q	Q	9	Q	Q.	2	Q	2	2	QV	QN Q
I-Chlorohexane	J/Bn	2	2	2	2	2	2	2	2	2	9	2	Q	ON.	2
2-Chloroethyl vinyl ether	ng/L	Q	Q	S O	QN	Q	Q	Q	Q	Q	QN	QN	Q	Q.	2
Chloromethane	ng/L	2	2	2	2	9	2	9	2	2	2	QN	2	QN	2
2-Chlorotoluene	ug/L	Q	Q	Q	Q	Q	Q	Q	QN	2	Q	S	QN	٧	ž
Dibromochloromethana	7/Bn	9	2	2	2	2	2	2	2	QV	ON.	QN	2	2	2
Olbromomethane	ug/L	Q	Q	Q	2	Q	2	QN	2	S	2	Q	2	- Q	S
I,2-Dichlorobenzene	ng/L	Q	2	2	9	2	9	9	9	2	9	9	9	9	₽
1,3-Dichlorobenzene	ng/L	QN	Q	QN	Q	S	Q	Q	9	2	ð	Q	QN	Q	S
1,4-Dichlorobenzene	T/Bn	Q	2	9	QN:	Q	2	2	2	2	2	9	2	2	2
Dichlorodifluoromethane	ug/L	Q	Š	ON	QN	2	S	QN	Q	Q	Q	QN	Q.	Ϋ́	Ϋ́
i,1.Dichloroethane	7/Bn	2	2	9	Ë	-	9	Q	2	9	2	2	9	QV	Š
1,2-Dichloroethane	ng/L	Q	8	Q	Q	QN	Q	Q	QN	S	Q	QN	Q	QN	S
1,1-Dichloroethene	T/Bn	Q	2	2	웃	Q	₽.	Q	Q	Q	QN	2	2	Q	2
cis-1,2-Dichloroethene	ng/L	2	9	Q	QN	Q	QN	QN	Q	Q	Q	QN	ND	¥	ž
cls-1,3-Dichloropropene	7/8n	ž	¥	ž	¥	ž	Ϋ́	Ą	¥	ž	¥	¥	¥	Q	2
trans-1,2-Dichloroethylene	ng/L	Q	Q	Q	QN	Q	2	QN	2	Q.	ON	.QN	Q.	2	S
1,2-Dichloropropana	7/Bn	2	2	2	2	9	2	2	2	2	2	9	2	9	S
trichlorofluoromethane	ng/L	Q	Q	Q.	Q	9	ᄝ	QN	N O	S	Q	QN	2	QN	QN
Dichloromethane	1/6n	9	2	. 9	÷	9	2	2	2	2	2	2	2	2	2
1,1,1,2-Tetrachloroethane	ng/L	Q	Q	Q.	9	2	ş	2	Q.	Q	2	Q	9	QN	N
1,1,2,2-Tetrachloroethane	J/Bn	ON	ON	QN	2	9	9	2	9	S	2	2	2	2	. g

TABLE OR - ST-00 (PPO: 12) GROUND WATER SAMPLING ANALYSIS RESULTS

USAF - 45th Space Wing Contamination Assessment Report ST-29 (PPOL-2) Revision: 0 November 9, 1994 Table 2-6 (Page 2 of 5)

PARAMETER.	Sile?	Units Round 1 Round 2	Round 2	Bound 1	Round 2	Round 1	Round 2	Round 1 Round 1	Bound 1	Round 2	Round 1 Bound 9		Round	Polind 4	
			in and in a	· Principal		Control of the Contro					7 7177			יייייייייייייייייייייייייייייייייייייי	
Tetrachloroethylene	ng/L	QN	Q	Q	Q	Q	S	Q	2	2	QN			S	QN
1,1,1-Trichloroethane	T/Bh	9	2	2	9	2	2	2	2	2	2	Q	2	2	S
1,1,2-Trichloroethane	ug/L	ð	Q	2	Q	Q	2	Q	S	Q	8	Q	Q	2	2
Trichloroethylene	7/Bn	2	2	2	2	2	2	2	2	9	9	8	Q	QN	2
1,2,3-Trichloropropane	ug/L	Q	ð	2	Q	ð	S	Q	S	Q	Q	Q	Q	S	S
Vinyl Chloride	7/Bn	2	9	9	Q	9	2	Q	2	2	9	2	QN	2	2
trans-1,3-Dichloropropylene	ng/L	Q	Q	9	Q	Q	Q	2	Q	2	2	2	QN	QN	S
Ethylbenzens	J/Bn	9	2	2	2	2	2	•	4	43	Q	2	QN	QN	QN
Toluene	ng/L	Q	QN	Q	Q	Q	2	QN	Q.	S	2	QV	Q	Q	2
Xylenes, (Total)	na/L	2	9	(gly	QV /	g	2	9	2	2	9	9	Q	QV	2
Methyl tert-butyl ether	ng/L	Q	Q	15	ND	Q	Q	QN	Q	9	2	Q.	Q	2	2
Total VOA	Ug/L	0.0	0.0) 🚾	0'0	-	0.0	4	7	69	0.0	0.0	0.0	0.0	0.0
Semi-Volatile Organics (ÚSEPA Method SW846 8270)	PA Meth	od SW846	\$ 8270)												
Acenaphthene	ng/L	2	2	Q	2	Q	2	9	2	Q	Q	2	QX	Q	2
Acenaphthylene	ng/L	ð	2	Q	2	9	Q	S	Q	2	2	Q	Q	S	2
Anthracens	ng/L	2	2	2	2	9	S	2	2	2	2	2	QN	QN	Q
Benzidine	ng/L	Q	Q.	2	Q	Q	Q.	Q	Q	9	2	Q	2	2	2
Benzo(a) anthracens	J/Bn	2	2	Q	2	2	2	9	2	Q	Q	Q	QV	ž	ž
Benzo(b)fluoranthene	ng/L	Q	Q	Q	S	Q	2	Q	Q	g	2	Q	ð	Q	2
Benzoic Acid	ng/L	NA	¥	٧	Ϋ́	¥	ž	Ž	W	ž	Ą	ž	٧٧	Q	2
Benzo(k)fluoranthene	ng/L	2	Q	2	Q.	Q	S	Q	Q	9	2	9	Š	ð	2
Benza(ghl)perylene	ug/L	2	2	QN	Q	2	2	9	2	9	2	2	2	2	2
Benzo(a)pyrene	ng/L	Q	ð	8	Q	2	9	Q	2	Q	2	Q	9	QN	2
Benzyl alcohol	ng/L	W	Ä	Š	ž	ž	ž	ž	ž	¥	¥	ž	Ϋ́	Q	S
Bis(2-chloroethoxy)methane	J/Bn (9	Q	9	Q	2	온	Q	Q	Q	Q	Q	QN	QN	S
Bis(2-chlaroethyt) ether	7/Bn	2	2	Q	2	2	2	9	2	2	2	2	9	QN	Q
Bis(2-chloroisopropyi)ether	ug/L	2	2	Q	2	2	2	9	Q	2	Q	Q.	2	Ş	S
Bis (2-ethylhexyl) phthalate	ng/L	2	2	9	2	2	2	9	21	2	18	9	QV	Q	Q
4-Bromophenyl phenyl ether	r ug/L	Q	ð	2	œ	2	Q	2	2	Q	Q	N.	S	Ş	2

TABLE 2-6 - ST-29 (PPC) -2) CACIUN WATER SAMPI ING ANALYSIS RESUITS

1 AMLE 2-6 - ST-29 1-POIL-2) GHOLIN WATEH SAMPLING ANALYSIS HESULIS

USAF - 45th Space Wing Contamination Assessment Report ST-29 (PPOL-2) Revision: 0 November 9, 1994 Table 2-6 (Page 3 of 5)

		Units Bound 1 Bound 9	1				7	Pariod + Pariod			*	1.0			
PARAMEIER		2000	ב שנוחסת	Round 1	Round 2	Hound 1	Konna 2	ביייים ביייים		Haund 2	Round 1	Round 2	Round 2 B	ב הנוסמ	
4-Chloroaniline	ng/L	¥ ¥	¥ Z	¥ X	AN A	¥	AN	¥			4	1			1
4-Chloro-3-methylphenol	ng/L	2	2	2	9	9	2	Q	2	QN	2	Ş	<u> </u>	2 2	2 2
2-Chloronaphthalene	ug/L	Q	Q	Q.	Q	S	Š	QN	QN	S	2	<u> </u>	2	2	2 :
2-Chlorophenol	√Bn	2	2	2	QN	Q	Š	Ş	2) {	2	}	2	2	2
4-Chlorophanut ahanut athar		5		•					2	2	2	2	2	2	2
		2	2	2	2	2	9	2	Q	2	2	2	Q	2	Q
	ng/L	2	2	Ş	2	2	2	2	2	Q	Q	2	Q	2	g
Di-n-butyl phthalate	ng/L	2	Q	Q	9	QN	Q	Q	QN	QN	Q	Q	2	Ş	2
Dibenz(a,h)anthracene	J/Bn	2	ž	2	ž	Q	¥	9	2	ΝΑ	QN	Ϋ́	Ņ	2	2
1,2-Dichlorobenzene	ug/L	Q	2	S	ğ	2	Q	Q	Ş	Ş	Ç	2	•	1	!
1,3-Dichlorobenzene	7/Bn	9	9	QN	9	QV	2	QN	QN) S	2	2	2 5		2
Dibenzofuran	ug/L	Y Y	¥	¥	¥	¥	Ϋ́	Ą	ΨN	Ą	2	2 3	2 :	2 :	2
3,3'-Dichlorobenzidine	1/Bn	2	2	ON.	QV	QN	CZ	: S	: CN	<u> </u>	Ş <u>Ş</u>	<u> </u>	¥ :	2	2
2.4-Dichlorophanol	na/L	Q	Ş	Ş	Ş	Ş	2	1		:	2	2	2	Q	Q N
Diethyl phthalate	, J/BI	2	2	QN	e ç	2 2	2	2 2	2 5	2 9	Q :	2	9	2	Ş
2 4-Dimethylphenol	-	Ç	2	2			:	2	2	n N	2	2	2	2	Ş
	3	2	2	2	2	2	2	2	2	2	2	2	윤	S	S
Dimethyl phthalate	T/Bn	2	2	2	2	2	Q	2	ON	Q	9	9	9	9	2
Di-n-octyl phthalate	ng/L	9	2	2	Q	2	Q	Q	2	Q	Q	Q	2	9	2
4,6-Dinitro-2-mehtylphenol	ng/L	2	2	9	2	2	9	9	9	2	2	2	CN	Ş	2
2,4-Dinitrophenol	ug/L	Q	Q	Q	Q	2	S	Q	2	Q	Ş	Ş	2	2	2 9
2,4-Dinitrotoluene	-T/6n	2	9	9	9	QV	QV	QN	QN	CN	5) 2	2	2 2	3
2,6-Dinitrotoluene	ng/L	Q	2	2	Š	Q	QN	Š	٤		9	1	2 :	2 :	2
Fluoranthene	701	Ş	Š	4	2	2	! {	} ;	2	2	2	2	Q	2	2
] } }		2 :	2	2	2	2	Q	9	2	2	2	9	9	2
TIUOTENA	ng/L	2	2	2	2	₽*	2	2	2	9	2	Q	Q	Q	Ş
Hexachlorobenzene	ng/L	2	9	2	Q	Q	Q	Q	Q	9	2	9	2	2	2
Hexachlorobutadiene	ng/L	2	2	Q	Q	QN	9	오	Q	Q	Q	QN	Q	QN	2
Hexachlorocyclopentadlene	T/Bn	2	2	2	Q	2	2	QN	98	2	2	2	2	9	S
Hexachloroethane	ug/L	2	ð	Q	Q	QN	Q	QN	Q	Q.	QN	N	QN	Q	2
Indeno(1,2,3-cd)pyrene	ng/L	QN	Q	QN	Q	9	Q	9	2	9	2	2	2	9	S
Isophorone	l/gu	2	2	Q	Q.	Q	2	Q	Q	Q	2	2	2	Q	S
2-Methylnaphthalene	//Bn	Ϋ́	¥	Ϋ́	NA.	NA	¥	ž	٧	¥	Ϋ́	NA	ΝΑ	CZ	Ş
2-Methylphenol	l/Bn	¥	¥	Y Y	N A	¥	¥.	ž	¥2	Ą	VΝ	44	VIV	; ;	
				*****								2	42	2	

USAF - 45th Space Wing Contamination Assessment Report ST-29 (PPOL-2) Revision: 0 November 9, 1994 Table 2-6 (Page 4 of 5)

		PPOL24		PPOL2-5		PP012-7		Pol.	2		PPOL2-9		DUP	PPOL2.10	P.UP
PARAMETER	Units	Units Round 1 Round 2	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 1	Round 2	Round 1	Round 2	Round 2	Round 1	
Naphthalene	l/Bn	Q	ð	Q	Q	S	110	QN	8	2	Q	ð	S	S	2
2.Nitroaniline	/Bn	ž	A A	ž	¥	Ϋ́	Ą	¥	ž	ž	ž	¥	ž	9	2
Nitrobenzene	ng/L	õ	2	Q	S	Q	Q	Q	2	2	S	Q.	2	g	2
3-Nitroaniline	V B n	ž	ž	ž	ž	ž	≨	ž	¥	¥	¥	¥	≨	2	2
4-Nitroaniline	l/Bn	¥	Ϋ́	¥	¥	ž	٧	¥ Y	¥	¥ X	¥ X	¥		Q	2
2-Nitrophenol	T/dn	2	9	2	2	2	2	9	9	2	2	2	2	2	2
4-Nitrophenol	ug/L	Q	QN	Q	8	ð	Q	2	Q	ð	Q	S	2	Q	2
N-Nitrosodimethylamine	J/Bn	2	₽.	Q	2	9	2	2	9	9	9	2	9	QV	2
N-Nitrosodi-n-propylamine	ug/L	Q	Q	2	旲	ð	ND	2	Q	S	Q	Q	Q	Q	S
N-Nitrosodiphanylamine	7/Bn	2	2	2	2	8	8	9	2	2	2	2	2	Ç	2
Pentachlorophenol	ng/L	Q.	Q	Q.	Q	2	S	Q	Q	Q	Q	Q	2	오	2
Phenanthrene	1/Bn	2	2	2	2	9	9	2	2	ON .	QN.	QN	2	QN	2
Phenot	ug/L	2	Q	Q	Q	Q	S	2	Q	Q	S	Q	S	9	2
Pyrene	7/Bn	2	2	2	9	QN	9	2	2	2	2	2	Q	QN	2
1,2,4-Trichlorobenzene	ng/L	9	Q	2	S	Q	S	Q.	Q	Q	Q	Q	å	2	2
2,4,5-Trichlorophenol	l/Bn	¥	W	Ä	Ą	ž	¥	W	N.	¥	¥	. -	¥	QN	S
2,4,6-Trichiorophenol	ug/L	2	QN	Š	2	8	Q	9	Q	2	2	QN	9	·S	2
1-Methylnaphthalene	/Bn	ž	ž	ž	ž	¥	ž	ž	¥	Ą	ž	\$	¥	9	2
Total PAHs (-Naphthalenes)) ug/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Naphthlenes	7	•	•												200000000000000000000000000000000000000

(PEC: 2) CT. JNT..... TEL C. MP.... 3 AM... YSIS TOUTE

-. BLE -

USAF - 45th Space Wing Contamination Assessment Report ST-29 (PPOL-2) Revision: 0 November 9, 1994 Table 2-6 (Page 5 of 5)

		PPOL2-4		PPOL2-5	•	PP012-7		PPOLZ-8 DUP	PUP		PPOL2-9		DUP	DUP PPOL2:10	ā
PARAMETER	Units	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 1	Round 2	Units Round 1. Round 2. Round 1. Round 2. Round 2. Round 1. Round 1. Round 2. Round 2. Round 2. Round 2. Round 2.	Round 2	Round 2	Round 1	
LEAD (MCAWW 239.2) Total	Jon	10	10	QX	4.	47	-	9	QN	2	36.4	17	23	320	62
Dissolved	ng/L	Q.	2	Q.	2	ð.	Q.	å	9	2	2	ð	9	9	2
TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (USEPA METHOD E418.1) TRPH ND ND ND ND ND ND	ROLEUM mg/L	M HYDROC ND	CARBONS	S (USEPA I	METHOD E	5418.1) ND	ON .	QN	QN	QN.	QN -	ON	ΩN	ND	ΩN
Notes: NA = Not Analyzed	. ६			٠.		<i>:</i>	·								
ND = Not detected															
DUP = QC/QA Duplicate Sample	mple.							٠							
J = Estimated Value. Detected, but below quantitation limit	ted, but	t below qu	antitation	limit.											
Round 1 Ground Water Samples Collected June 17 through	ples Co	ollected Ju	une 17 thro	yut July	16, 1993 (POL2-5 r	esamples	for SVOC	s July 16,	1993 due	July 16, 1993 (PPOL2-5 resamples for SVOCs July 16, 1993 due to laboratory error.)	ory error.)			
Round 2 Ground water samples collected August 18 and 19, 1993 (PPOL2-4 resampled for VOCs, SVOCs, TRPH, Total Dissolved Pb October 8, 1993 due to laboratory error.)	ples col	fected Au	gust 18 ar	ld 19, 199:	3 (PPOL2-	f resample	ed for VOC	Ss, SVOCs	s, TRPH, T	otal Disse	olved Pb O	ctober 8, 1	993 due t	o laboratory	/ error.)
Monitoring Well PPOL2-10 sampled for VOCs and SVOCs,	ampled	for VOCs	and SVO		ry 1994; \$4	impled for	January 1994; sampled for TRPH, Total Dissolved Pb. February 1994	ital Dissoft	ved Pb. Fe	sbruary 18	994.	٠			

-- BLF - - - ST ... (PFO: 2) COUNTY IN THE CAMPING AND YSIS DESULTS

GROUND WATER ELEVATION (MSL.) SHALLOW GROUND WATER MONITORING WELL LEGEND PP0L2−7 ◆

PP0L2-6

GROUND WATER ELEVATION CONTOURS (MSL)

, ^ô`,

GROUND WATER FLOW DIRECTION ARROW

GEOLOGIC CROSS-SECTION CUT

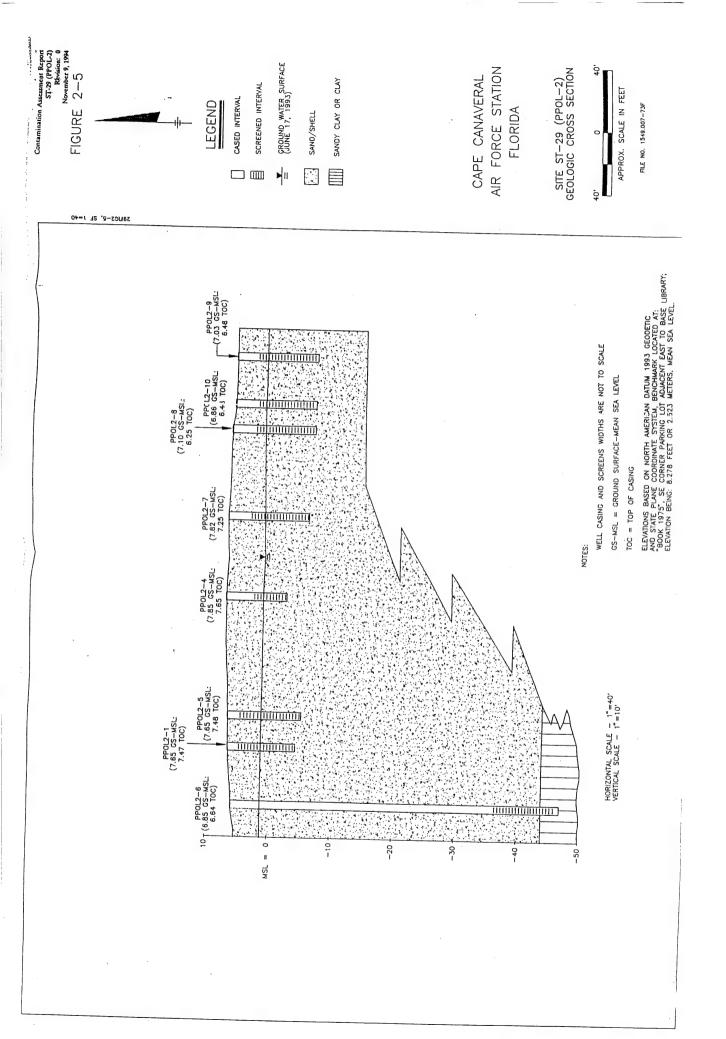
AIR FORCE BASE PATRICK FLORIDA SITE ST—29 (PPOL—2)
GROUND WATER ELEVATION
CONTOUR MAP
(SEPTEMBER 29, 1994) 0

APPROX. SCALE IN FEET

FILE NO. 1549.007-72F

..... PARKING NOTE: MONITORING WELL PPOL2—60 CLASSIFIED AS "DEEP" WELL PARKING -FORMER 500-GALLON WASTE OIL UST (REMOVED 1992) OPINE FOR STATE ASPHALT PARKING LOT 8606. 736 PPGL2-3 FURRENT CAMORY FOR Aloc. 739 لنسن (::) ASPHALT PARKING LOT ::7

PPOL2, SF 1=60



APPENDIX A-2 GROUNDWATER DATA FROM PARSONS ES, 1995B

TABLE 4.3

FUEL HYDROCARBON COMPOUNDS DETECTED IN GROUNDWATER, MARCH 1994 SITE ST-29 INTRINSIC REMEDIATION TS PATRICK AFB, FLORIDA

						-							
Sample Location	Sample	Sample	Benzene	Toluene	Ethylbenzene	p-Xylene	m-Xylene	o-Xylene	Total Xylenes	Total BTEX	1,3,5-TMB	1,2,4-TMB	1,2,3-TMB
			15 A.X	To Harr	U.B.L.	(1/8/17)	(J/B/L)	(IIB/L)	(IIB/L)	(IIB/L)	(11R/L)	(µg/L)	(µg/L)
CPT-01	CPT-86-001	3-23-94	BIOV	243	010								
CPT-02S	CPT-86-002S	3-21.04	17.	1001	אַרָּי	779	BLQ	DLQ	1110	2.42	BLQ	DLQ	BLQ
CPT-02D	CPT-86-002D	1.23.94	-	12	103	99	353	6=	638	1196.9	71.2	NAW	86.3
CPT-03S	CPT-86-003S	1-23.94	77.4	717	1.1	1.4	2.6	4.	5.4	9.7	BLQ	٧×	1.3
CPT-03M	Cl. I. 86-003M	3-23-94	207	751	823	1220	2410	1390	5020	7304	347	٧×	403
CPT-03D	CPT-86-003D	3-23.94	2	2 -	60.0	7.76	24	7.5	73.7	336.8	2.8	٧٧	91
CPT-04S	CPT-86-004S	1-23.94	2 2		O I	2711	1.4	11.0	1.4	4.3	0.10	٧×	131,0
CPT-04D	CPT-86-004D	3-25-94	2 2	37	2,0	210	0711	110	11.0	9	อาต	BLQ	11,0
CPT-05S	CPT-86-005S	3-25:94	20		270	275	0711	11.0	111.0	3.7	678	DLQ	IILO
CPT-06S	CPT-86-006S	3-25-94	NO.	=	7 0	7 .	0,11	07	111.0	1.2	DTG	۲×	11.0
CPT-07S	CPT-86-007S	3-25-94	DI O	10	770	2.10	2.3	BLQ	3.6	14.7	BLQ	٧٧	11.0
CPT-08S	CPT-86-008S	3-25-94	1018	2 8	270	מוס		27	-	4.9	DLQ	٧×	BLO
CPT-09S	CPT-86-009S	3-25-94	1	7	DI O	270	0711	BEO.	DIG	2.8	ЫQ	BLQ	DI.O
CPT-09D	CPT-86-009D	3-25-94	477	191	Yig	ארות	7111	BLQ	11.0	9	BLQ	nro	BLO
CP.T-10S	CPT-86-010S	3-25-94	210	-		/ 10	17.1	7.7	33.5	477.5	BLQ	NA	9.4
CPT-11S	CPT-86-011S	3.25.94	2 2	-	270	770	ISLQ	071	11.0	3.1	рго	0.10	IILO
CPT-128	CPT-86-012S	3-25.94	202	- -	BLO	DIE C	010	III.Q	BLQ	-	อาต	DILQ	110
CPT-12D	CPT-86-012D	3.25.94	916		Y II	7716	1.2	DEG	1.2	2.3	ВГО	٧×	III.0
CPT-13S	CPT-86-013S	3-25-94	BIO	8.4	7 6	6.4	- :	7.7	19.1	118.5	вго	NA	14
CPT-16S	CPT-86-016S	3-26-94	1-	10	201	10.4	5.4		18.9	56.4	ВГО	٧٧	6.7
CPT-16DD	CPT-86-016DD	3-31-94	010	1 6	N C	710	279	275	070	2.9	BI.Q	D1.Q	BLQ
CPT-18S	CPT-86-018S	3-24-94	DIO	17	73.7	3.6	2,	0111	31.0	1.9	BI.Q	DLQ	BLQ
CPT-18D	CPT-86-018D	3-24-94	8.3	2.1	OIL	210	0.0	4	14.4	18.4	1.4	۷V	9.1
CPT-18DD	CPT-86-018DD	3-31-94	BLO	3.5	DIG	210	2010	276	07151	10.4	BLQ	BLQ	DIA
CPT-19S	CPT-86-019S	3.24.94	BLO	BI,0		-	27	270	27:	3.5	BLQ	91.0	BLQ
CPT-19D	CPT-86-019D	3-24-94	1.5	BLO	BLO	BLO	DIO	270	7.4	2	BLQ	Ϋ́	BI.Q
CPT-20S	CPT-86-020S	3-24-94	BLQ	2.1	BLO	=	17	2	770	?	010	BLQ	BLQ
CPT-20D	CPT-86-020D	3-24-94	BLQ	BLQ	BLO	BLO	DIE	2 2	9 10	0 2	2711	٧×	-
CPT-218	CPT-86-021S	3-25-94	٧٧	5.1	BLO	DIO	BIO	2 2	7 0	7:1	775	BLQ	BI.Q
CPT-21D	CPT-86-021D	3-25-94	¥	BLO	BLO	n o	2012	210	276		BEQ	٧×	BLQ
CPT-22S	CPT-86-022S	3-26-94	۸A	1.9	BLO	BLO	2 10	3 2	710	37	111.0	210	11.0
CPT-22D	CPT-86-022D	3-26-94	1.5	DI.Q	DTG	BLO	110	30	2 2	?	NIN O	0711	110
CP 1-238	CPT-86-023S	3-25-94	BLQ	BLQ	BLQ	BLQ	1.7	107	-	1.2	S In	27.	071
Cr.1-23D	CPT-86-023D	3-25-94	BLQ	BLQ	. ple	BLQ	BLQ.	BLO	DIC	012	DIC O	AN C	0111
Cr.1-145	Cl. 1-86-024S	3-26-94	BLQ	BLQ	BLQ	BLO	BLO	DIE!	2 2	7 0	7010	27:10	275
								Y	7777	770	131.0	200	070

TABLE 4.3 (CONCLUDED)

FUEL HYDROCARBON COMPOUNDS DETECTED IN GROUNDWATER, MARCH 1994 SITE ST-29 INTRINSIC REMEDIATION TS PATRICK AFB, FLORIDA

									Total	Total			
Sample	Sample	Sample	Benzene	Toluene	Ethylbenzene	p-Xylene	m-Xylene	o-Xylene	Xylenes	BTEX	1,3,5-TMB	1,3,5-TMB 1,2,4-TMB	1,2,3-TMB
Location Number	Number	Date	(1/B/l)	(µg/L)	(hB/L)	(µg/l.)	(µg/L)	(µg/I.)	(µg/I.)	(µg/L.)	(1/8/1)	(hB/I.)	(µg/L)
CPT-24D	CPT-86-024D	3-26-94	BLQ	BLQ	дη	BLQ	BLQ	BLO	BLO	BLO	BLO	BLO	BIO
CPT-25S	CPT-86-025S	3-26-94	DLQ	2.1	2.3	4.1	6.9	3.5	14.5	18.9	1.7	Y Z	5-1
CPT-25D	CPT-86-025D	3.26-94	BLQ	1	BI.Q	11.0	1.4	BLO	4.1	2.4	BLO	Š	BLO
CPT-26S	CPT-86-026S	3-26-94	BLQ	1.1	BLQ	9.18	BLQ	BLO	0,181	-	131.0	N.O	Z Z
CPT-26D	CPT-86-026D	3-26-94	BLQ	-	BLQ	BLQ	ВГО	BLO	BLO	-	131.0	2018	2 18
CPT-14D	CPT-86-0141)	3-25-94	096	9.91	11.5	39.2	36.8	44.2	120.2	1108.1	15.1	Y Z	23
MIW-100	CPT-86-100	3-23-94	7	BLQ	O'ISI	=	1	BLO	2.1	6.3	OIN	0 12	C IS
PB5	CPT-86-P135	3-26-94	BI.Q	131.0	D.IEI	BLO	BLO	OIN	OIN	0 18	0 121	2 2	7 5
NIW-101	Cl ⁷ F-86-101	3-23-94	111.Q	DII.Q	111.Q	131.Q	131.0	0,181	018	BLO	OIN	2013	2018
MW-102	CPT-86-102	3-23-94	DI.Q	DI.Q	BLQ	D.IE.	IILQ	BLO	0.181	0.161	010	DIO	N C
MW-103	CPT-86-103	3-23-94	DT.Q	111.Q) H	Ϋ́ΙΕ	DI.Q	111.0	11.0	BLO	OTH	OH	OIN
PPO1.2-6	CPT-86-PPOL2-6 3-26-94	. 3-26-94	131.Q	BLQ	11.0	O'IEI	DI.O	010	0,181	018	OIE	0 18	2 2
PPOL2-1	CPT-86-PPOL2-1	3-26-94	BLQ	ЫQ	ЫQ	DI.Q	1.4	IILQ	1.4	7.	131.0	11.0	III.0

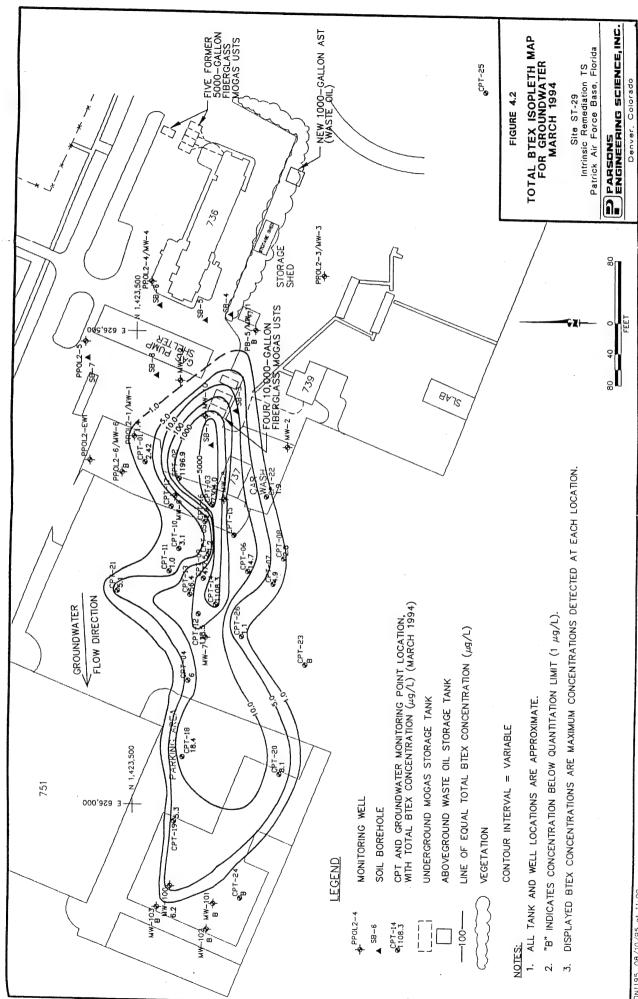
^ν BLQ = Below quantitation limit, or < 1 μg/L. ^ν NA=Not available.

FUEL HYDROCARBON COMPOUNDS DETECTED IN GROUNDWATER, MARCH AND MAY 1995 SITE ST-29 INTRINSIC REMEDIATION TS PATRICK AFB, FLORIDA

Г		1	_	Τ-	Т	T	_	$\overline{}$	T	Т	Т	Т	T	Τ-	T	Т	T	Τ	Т	T	Т	Т	Τ	Т	Т	Т	T	T	1	Т	Т	Т	
TOC (mg/L)	14.0	163	13.8	2 V V	35.8	181 9	21.8	-	10.9	6.1	9.5	3.4	7.8	7.5	7.5	4.6	5.8	4.2	4	3.3	Ş	4.9	٧×	٧×	¥ _N	Š	ž	٧٧	×	ž	ź	٧×	YZ.
Total TMB (µg/L)	13 911	340.45	6.24	6.32	57	4530.83	10.09	7.15	5.23	1.27	1.04	2.37	3.09	3.11	3.12	CIN	CIN	CN	GN	QN	ΩN	QN	٧×	٧×	٧٧	٧×	٧٧	٧٧	٧٧	NA	NA	٧٧	٧٧
1,2,3 TMB (µg/L)	80 18	89.97	2.87	3.26	18.58	850.57	7.26	3.6	2.75	1.27	(N	(N	1.98	1.84	1.42	GN	GN	CIN	GN	CN.	GN	CIN	٧٧	NA	NA	٧×	ž	××	××	٧٧	٧N	×z	٧ <u>٧</u>
1,2,4 TMB (µg/L)	203.4	202.48	1.97	1.64	30.67	2903.48	1.45	2.46	1.33	CN.	GN.	1.31	GN	QN	1.7	S	QN.	QN	GN	GN	ND	GN	NA	NA	NA	NA	ΝΑ	٧٧	٧×	٧×	٧×	NA	NA
1,3, 5 TMB (µg/L)	43.95	48	1.4	1.42	7.75	776.78	1.38	1.09	1.15	Î	1.04	1.06	1.11	1.27	GN	CIN	QN	QN	CIN	CIN	CIN	UD	NA	۷۷	NA	NA	NA	NA	NA	٧٧	NA NA	NA	NA
Total BTEX (µg/L)	\$66.4	583.21	68.28	62.64	292.99	14095.76	64.29	7.38	3.53	1.08	96.0	1.67	4.54	4.55	0.99	1.03	BLQ	ND	CIN	ON	CIN	QN	CN	CIN	ON	CIN	ND	ND	2945	83	160	CIN	3220
Total Xylene (µg/L.)	260:27	284.99	26.84	20.95	122.75	8820.63	14.18	5	3.53	1.08	96.0	: BLQ	3.54	3.58	66.0	1.03	BLQ	ND	ND	QN	ON	QN	QN	ON	CIN	QN	ND	QN	2450	ND	220	QN	2310
o-Xylene (µg/L)	8.58	9.36	1.39	2.05	32.14	2498.73	5.36	1.45	0.99	nrg	QN	Î	1.35	1.3	GN	BLQ	GN	ΩN	ND	Î	R	Q.	Ϋ́	٧٧	٧×	NA	٧٧	ΝΑ	٧٧	NA	٧٧	۲	٧×
m-Xylene (µg/L)	156.04	168.18	2.96	1.12	32.43	3466.78	4.01	1.73	1.33	1.08	96.0	BI.Q	1.13	1.22	0.99	1.03	BLQ	GN	(IX	CIN	R	<u>S</u>	×	٧N	٧N	٧٧	۷V	۷N	٧×	NA	٧N	¥N	VN
p-Xylene (µg/L)	95.65	107.45	22.49	17.78	58.18	2855.12	4.81	1.82	1.21	BLQ	BLQ	BLQ	1.06	1.06	BLQ	BLQ	BLQ	ND	ND	QN	CIN	QN	٧×	٧٧	٧٧	٧×	٧N	NA.	٧N	٧٧	NA	AN	¥N
Ethylbenzene (µg/L)	132.59	135.4	10.49	10.39	21.8	2252.51	0.98	1.29	918	BLQ	91.0	QN.	nro	BLQ	П.Q	BI.Q	CN	CIN	CN	GR	CIN.	CIN	CN	QN	CIN	QN	OIN	ND	270	46	360	ND	700
(Jrg/L.)	6.25	6.37	BLQ"	0.99	14.03	1526.23	4.35	BLQ	BLQ	ND	Q.	1.67	-	0.97	Q.	BI.Q	Q	QN	(N	Q	Q	2	GN	QN.	QN	Q	Q	2	82	Q.	Q.	Q.	CN
lsenzene (μg/L.)	167.29	156.45	30.95	30.31	134.41	1496.39	44.78	1.09	BI.Q	BLQ	BLQ	01.0	131.0	BLQ	BLQ	BLQ	QN	QN	Q.	Q.	QN	Q.	<u>R</u>	QN	GN.	QN	QN	QN	140	37	180	QN	210
Sample	3/23/95	3/23/95	3/23/95	3/23/95	3/23/95	3/23/95	3/25/95	3/25/95	3/25/95	3/25/95	3/26/95	3/26/95	3/25/95	3/23/95	3/23/95	3/31/95	3/24/95	3/31/95	3/24/95	3/23/95	3/25/95	3/23/93	5/95	5/95	5/95	5/95	5/95	5/95	5/95	5/95	5/95	5/95	5/95
Sample Number	S	2S DUP	3D	3D DUP	3M	38	9D	. S	12D	12S	26D	265	86-41)	86-4S	86-45 DUP	86-16DD	86-MW18D	98-MW18DD	86-MW18S	86-MW100	86-MW21D	80-MW21S				•	•		•		•	•	
Location	CPT-02S 2S	CPT-02S 2:										1			\neg		\neg	٥		1		T	MW-1	MW-2	MW-3°	WW4.	MW-6"	MW-7°	MW-8°	MW-9°	MW-10*	MW-11°	MW-12°

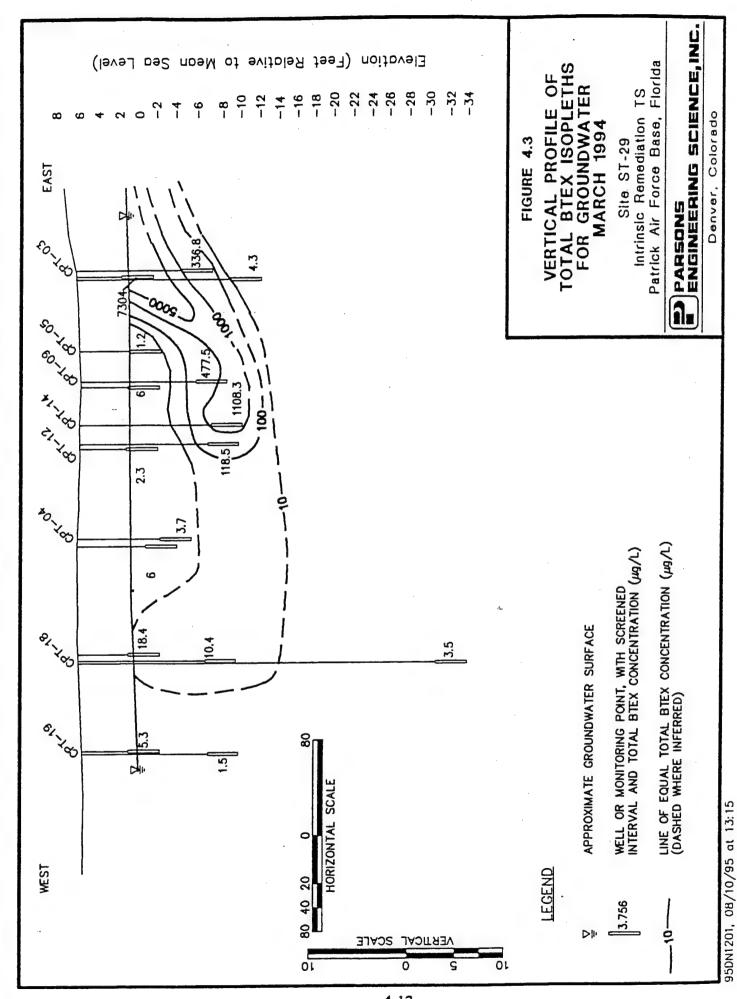
a/ BLQ = Below limit of quantitation, 1.0 µg/L. b/ NA = Data not available or sample not analyzed for this parameter.

c/ ND = Compound not detected at the method detection limit.
d' Sample collected and analyzed by CI12M Hill on May 10 and 11, 1995.



95DN1195, 08/10/95 at 11:00

4-11



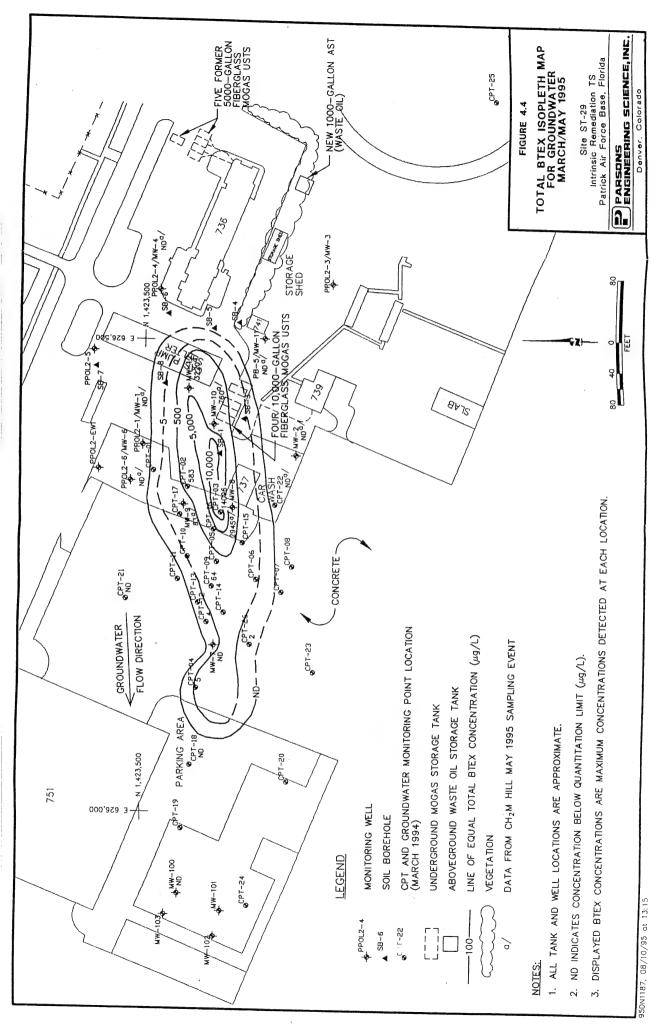


FIGURE 4.5A

PLOT OF TOTAL BTEX VERSUS TIME FOR SAMPLING LOCATIONS WITH DECREASING BTEX CONCENTRATIONS SITE ST-29 INTRINSIC REMEDIATION TS PATRICK AFB, FLORIDA

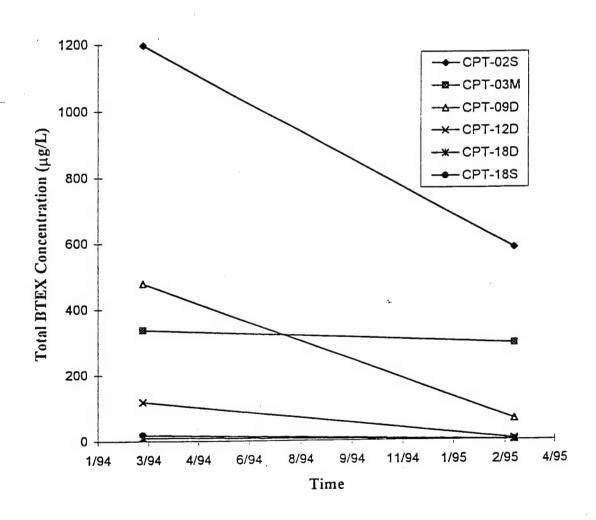


FIGURE 4.5B

PLOT OF TOTAL BTEX VERSUS TIME FOR SAMPLING LOCATIONS WITH INCREASING BTEX CONCENTRATIONS SITE ST-29 INTRINSIC REMEDIATION TS PATRICK AFB, FLORIDA

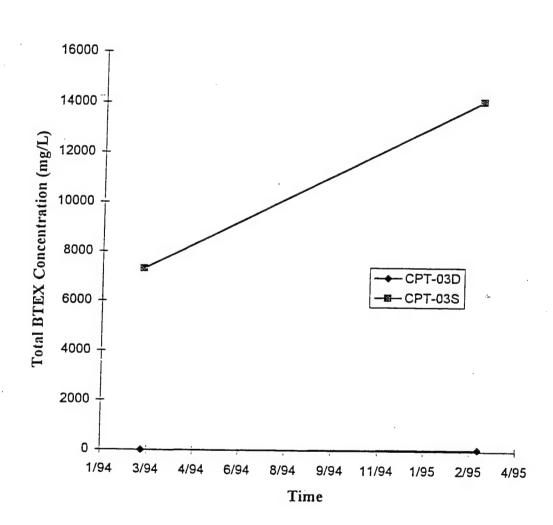


TABLE 4.5

GROUNDWATER GEOCHEMICAL DATA, MARCH 1994 SITE ST-29 INTRINSIC REMEDIATION TS PATRICK AFB, FLORIDA

_												_									_					_	_				_	_	,	
	Methane	(mg/L)	4.99	5.953	14.953	1.63	3.164	14.021	3.756	7.661	4.858	6.595	6.339	1.742	4.236	3.797	3.493	4.244	0.983	5.372	2.043	8.793	٧N	0.781	4.56	۷N	٧X	2.136	0.924	1.114	1.278	0.46	2.414	0.866
	TOC "	(mg/L)	14	8.9	16.9	5.4	10.9	63.1	5.6	9.9	12	3.8	3.4	10.1	12	10.2	21.3	٧×	8.1	10.5	7.2	12.8	NA	9.4	5.6	٧N	8.7	7.3	10.3	9.8	3.6	6.1	7.6	11.4
NO ₂ +NO ₃	Nitrogen	(mg/L)	0.13	0.13	0.12	0.12	0.11	14.8	0.00	0.19	0.17	0.13	0.12	0.1	0.11	0.1	0.13	0.15	0.12	0.1	0.12	0.11	NA	0.13	0.11	NA	0.12	0.1	0.11	0.07	0.1	0.14	0.29	0.12
	Sulfate	(mg/L)	4.37	ND2 d	ND2	ND2	2.52	118	1.47	ND2	98.9	7.03	2.52	8.51	15.3	6.64	9.5	15.9	3.86	8.38	6.94	3.68	NA	8.23	1.85	NA	86	1.51	8.85	ND2	25.5	13.3	25.5	٧٧
	Chloride	(mg/L)	44.4	45.7	42.6	41.6	40.7	132	12.4	12.5	23.6	47.8	30.2	44.7	34.7	14.3	56.6	12.7	28.1	15.2	35.5	34.6	NA	37.9	15	٧×	36.6	33.7	37.4	52	9.83	29.8	56.6	٧٧
Ferrous	Iron	(mg/L)	NA	0.4	9.1	0.4	0.3	1.2	9.0	9.0	0.1	0.3	1	1.9	0.2	0.7	0.2	0.4	0.1	0.1	0.3	0.3	NA	0.4	0.3	۷N	0.5	0.2	0.1	0.2	0.3	0.2	0.2	0.2
Hydrogen	Sulfide	(mg/L)	٧V	0.4	0.2	1	0	0.1	0.2	0.5	0.1	1.5	1.2	0	9.0	0	0	0	0.1	0	9'0	9.0	0.3	0.1	0.2	0	0	0.2	0	0.1	0	0.1	0	\$
Total	Alkalinity	(mg/L)	NA	330	498	315	398	520	212	215	215	148	254	420	422	340	192	210	329	592	362	460	NA	231	294	NA	286	328	335	380	148	304	245	415
Redox	Potential	(mV)	Ϋ́	-190	-156	-255	-50	-208	-266	-286	-160	-278	-250	09-	-200	-24	09-	-35	10	30	-230	-240	٧×	-190	09-	ΑA	25	-50	41	44	23	-20	20	-287
Dissolved	Oxygen	(mg/L)	0.4	9.0	0.2	ž	0.2	0.1	0.2	0.3	=	0.2	0.2	0.2	0.3	0.2	0.1	0.1	0.4	6.0	0.1	0.3	2.7	0.1	0.3	2.3	2	0.2	¥	0.3	1.5	0.2	3.2	0.1
	Conductivity	(nmhos/cm)	٧٧	177	1001	721	868	1733	457	469	488	437	577	974	938	530	460	808	715	564	801	906	٧×	776	620	٧×	834	744	800	842	368	716	610	936
		II.	NA &	7.1	6.7	7.3	7.1	6.7	7.2	6.9	7.3	7.6	7.2	7.1	7.1	7.3	7.3	7.2	7.2	7	7.3	7	٧×	7	7.1	٧×	6.9	7.1	7	7.1	7	7.2	7.1	6.9
Water	Temp.	(၁)	24.7	24.7	24.7	٧٧	26.4	26.4	26.1	26.9	26.4	25.1	25.3	25	27.8	27.3	56	25.9	27.1	27.3	25.7	25.5	26.7	25.5	26.1	27.3	26.6	26.6	٧×	. 25.7	25	26.4	56	25.4
	Sample	Number	CPT-86-001	CPT-86-002I)	CPT-86-002S	CPT-86-0031)	CPT-86-003M	CPT-86-003S	CPT-86-004D	CPT-86-004S	CPT-86-005S	CPT-86-006S	CPT-86-007S	CPT-86-008S	Clv1-86-0091)	CPT-86-009S	CPT-86-010S	CPT-86-011S	CPT-86-012D	CPT-86-012S	CPT-86-013S	CPT-86-014D	CPT-86-016DD	CPT-86-016S	CPT-86-018D	CPT-86-018DD	CPT-86-018S	CPT-86-019D	CPT-86-019S	CPT-86-020D	CPT-86-020S	CPT-86-0211)	CPT-86-021S	CPT-86-022D
		Location	T			7				T	1						\exists	\neg				-				٥							П	CPT-22D 0

TABLE 4.5 (CONCLUDED)

GROUNDWATER GEOCHEMICAL DATA, MARCH 1994 SITE ST-29 INTRINSIC REMEDIATION TS PATRICK AFB, FLORIDA

		Water			Dissolved	Redox	Total	Hydrogen						
Sample	Sample	Tema		Conductivites			Total I	i yarogen	rerrous			NO2+NO1		
Location		. duly.			Oxygen	Folential	Alkalinity	Sulfide	Iron	Chloride	Sulfate	Nitrogen	TOC	Methone
Location	Mumber	(2)	Hd	(nınhos/cın)	(mg/L)	(mV)	(mg/L)	(mg/L)	(mg/L)	(me/L)	(I/om)	(Dam)	(), (,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	o di di
Oce Trio										/ B = /	77.4	(11/8111)	(111B/L-)	(mg/L)
CI.1-778	Cl.1-86-022S	25.5	8.9	1271	0.3	-153	057	-	-	1000	00.			
CPT-23D	Cl ⁷ l ⁻ 86-023D	26.7	7.1	779	P 0	147	333	2	7! 6	0.00	128	0.07	10	3.218
CPT-23S	Cl ⁷ T-86-023S	26.5	0.9	757	2.5	101	332	7.0	0.7	36.1	1.49	0.1	8.2	2.282
CPT-24D	ClyT-86-024D	26	15	37.6	5.5	34	340	0	0.2	23.4	NI)2	0.12	6.4	1.992
CPT-24S	CPT-86-0248	25.7	1	0/0	0.5	00-	192	0.1	0.1	5.46	3.61	0.1	2.8	0.686
CD1. 261)	2 40 00 THO	1.07		358	1:7	30	190	0	0.1	6.63	ND2	0.12	3.6	200.0
CL 1-531)	CI.1-80-023I)	NA	7.1	892	×	69	171	C	A 1017	24.3	, ; ;		2:5	407.7
CPT-25S	Cl ³ T-86-025S	25	73	799	3.7	3 5				24.7	0.16	0.12	15.7	1.556
CPT-26D	CPT-86-026D	26.2	1	751		200	/61	0	Ē.	28	51.9	0.12	15.7	0.147
736.Trg	Chr. 46 mage	200		15)	7.0	567-	- 115.	3	P.0	6.14	8.61	0.11	2 3	2 0.61
107-1-12	C070-09-1	70	7.6	558	2.2	-20	26.1	0	- 0				5.0	107.7
MW-100	CPT-86-100	25.9	7.2	209	0.5	2.11	152	,		13.1	1.22	0.12	5	3.569
MW-101	CPT-86-101	26.5	7.2	533	0.3	2,17	200	7.0	Ö	6.1%	[6.3	0.12	18.6	2.821
MW-102	CPT-86-102	25.8	7.2	163		100	107	8.0	5	21.6	5.75	0.13	6	2.308
MW-103	ClvT-86-103	25.4	7.4	26.1	2.0	107-	067	0.5	- -	17.9	3.51	0.12	7.6	3.256
PBS	CPT-86-P135	010	1.	213	- 0	1/7	506	-	0	12.5	4.69	0.11	2.6	5.291
PPOL2-1	CPT-86-PPOL2-1	26.3	1,	7/17	7.0	-140	291	₹Z	<u>E</u>	51.4	4.45	0.1	YN N	+1414
PPOL2-6	CPT-86-PPOL 2-6		-	30100	- 0	077-	303	0.7	9.0	7	3.2	ICN	≤Z	5.33
				20100	7.0	-230	334	8.0	ΝΑ	10200	1150	Ī	YZ.	0.03.1

^{*} TOC = Total organic carbon.

WNA = Not available.

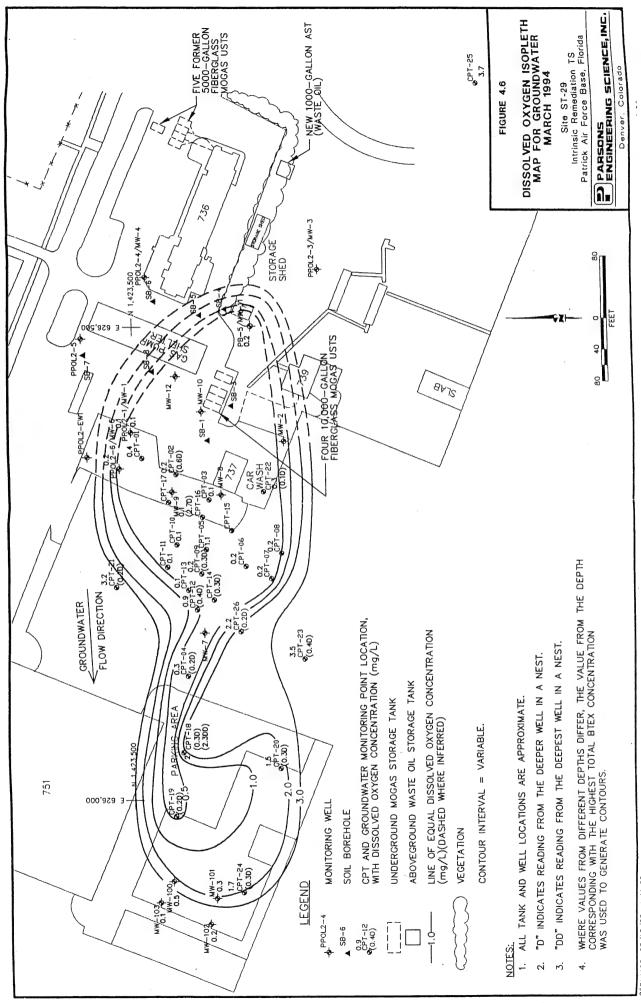
 $^{^{}c'}$ NI)2 = <0.5 ing/L. $^{\omega'}$ ND1 = <0.05 in/L.

TABLE 4.6

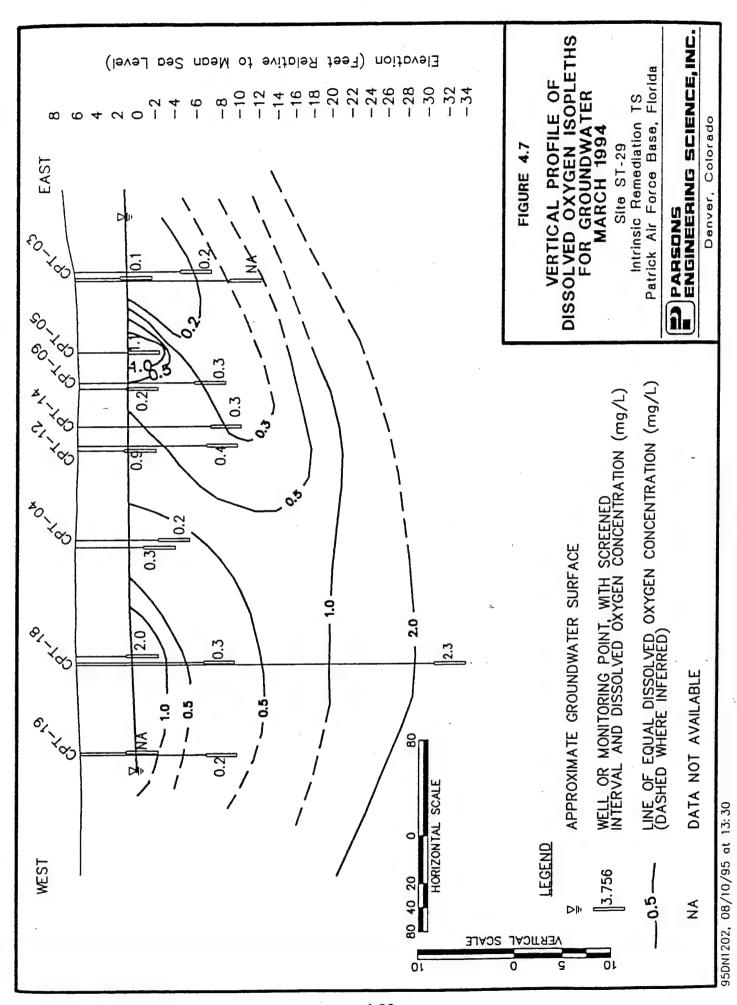
GROUNDWATER GEOCHEMICAL DATA, MARCH 1995 SITE ST-29 INTRINSIC REMEDIATION TS PATRICK AFB, FLORIDA

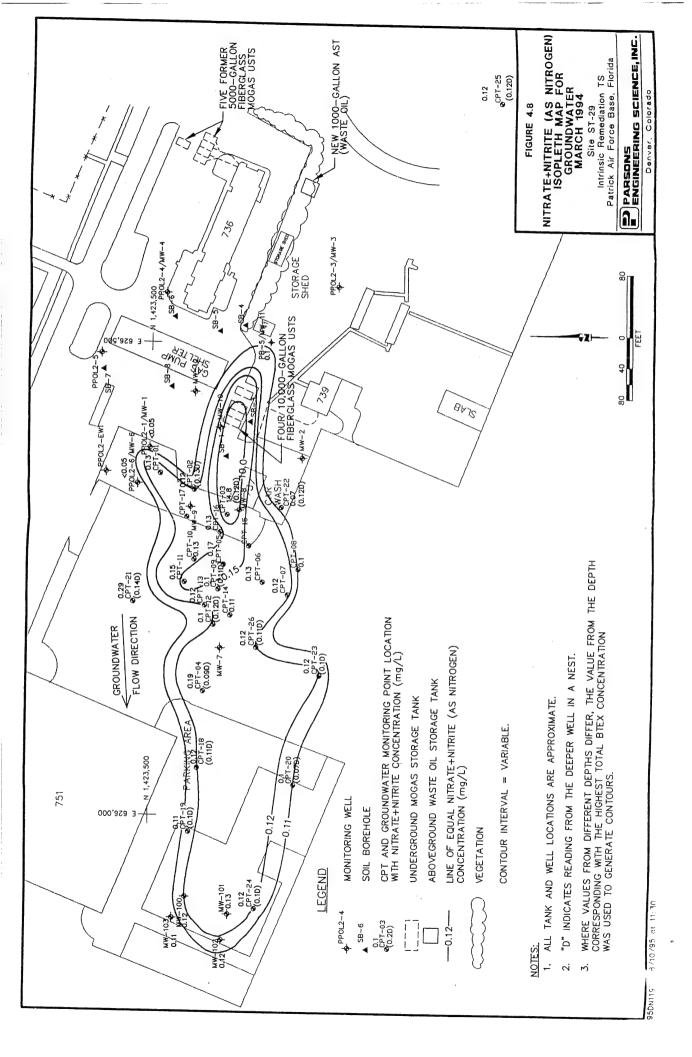
Methane	(11811)		12.846	14.15	2.57	۲ ک	12,437	15.534	9.839	5.822	1000	700.0	12.339	3.756	9.009	5.095	11.63	10.594	0.074	9119	8000	0000	3,379	٧×	0.749	9.857
xide	(m.g.m)	-	420	416	144	٧×	338	780	284	08	202	207	761	192	154	06	138	٧٧	238	86	376	0.7	021	132	96	190
Hydrogen Sulfide (ms/l.)	, a	,,,,,,	-VV	NA	5	٧٧	NA	٧٧	\$	_	_		_ .	2	0.7	\$	-	NA	NA	2	<0.1	20	0.7	0.3	S	0.7
Sulfate (mg/L)	, ,	:	1.13	1.08	15.7	٧×	19.6	Ξ	2.23	1.52	49.7	800		3.31	0.94	2.98	1.17	٧V	1200	1.08	196	705	2.00	2	38.8	0.52
Manganese (mg/L.)		100	70.1	<0.1	<0.1	٧×	<0,1	<0.1	<0.1	<0.1	<0.1	0>	,	70.	<0.1	<0.1	<0.1	٧×	<0.1	<0.1	<0.1	100		70.1	YZ :	VV
Ferrous Iron (mg/L.)		=			<0.05	VZ.	<0.05	0.1	<0.05	0.1	<0.0>	0.3	30 %	6.0	0.3	0.1	0.1	٧×	<0.05	0.1	0.1	0.2		5	0.0	0.0
		3 83	2 20	27.6	2	Š.	6.13	18.7	3.85	1.71	2.37	4.04	196	10.7	1.01	607	3.6	Ž.	16.9	1.52	16.2	0.35	0 23	100	100	7.74
Nitrate + Nitrite (mg/L.)		90.0	200	000	0.08	VZ.	0.00	<0.05	0.00	0.07	0.03	0.07	0.06	200	0.07	0.07	0.0	VV	<0.05	0.07	<0.05	0.07	700	0.07	800	0.00
oride Dissolved Oxygen Nitrate + Nitrite Ammonia (MgL) (mgL)		0.1	10	-	NA.	VN	9	- 6	0.1	0.1	<0.1	<0.1	0.1	-	- 5	10,	0.1	YZ o	0.1	1.0	0.2	0.1	0.0	0	- 0	
Chloride (mg/L)		62.7	67.7	3 95	2	3 5	130	631	27.0	2.40	20.9	14.4	51.2	13.2	187	200	0.2	VVI	20.07	0.62	0806	18.3	15.2	28.2		
Alkalinity (mg/L CaCO3)		404	407	341	×2	447	020	977	180	360	333	220	357	202	250	263	CON VIV	307	080	207	333	276	205	287	111	
Redox (mv)		-231	-225	-348	.347	192	187	701	270	240	240	-306	-342	-269	325	280	NA.	286	316		=	-287	-253	-307	-239	
Conductivity (µs/cm)		866	995	787	786	1019	2010	\$66	161	946	200	498	837	440	540	543	YN.	26900	659	2000	20200	6/3	429	674	381	
II2		6.54	6.53	7.02	7.04	6.77	6.72	6.78	7.38	6 03		60.	6.88	6.87	7.04	6.85	ź	7.13	6.87	7 10	200	0.83	7.32	7.18	6.92	
Sample Date	10000	3/23/95	3/23/95	3/23/95	3/23/95	3/23/95	3/23/95	3/25/95	3/25/95	30/56/1	30,500	3/23/93	3/26/95	3/26/95	3/25/95	3/23/95	3/23/05	3/11/05	3/24/95	3/11/2	2011010	3/24/93	3/23/95	3/25/95	3/25/95	
Sample Number	200	63	2S DUP	3D	3D DUP	3NI	3.5	OI)	86	120	100	671	701)	265	86-41)	86-45	86-45 DUP	86-16DD	86-NIW18D	(ICI81W) 4-98	201 M 10-00	00-N1W-00	86-N(W100	86-MW21D	86-NIW21S	
Sample Location	Γ	T			CPT-03D	CPT-03M	CPT-03S	CPT-09D	CPT-09S	CPT-12D	Τ	T		CPT-26S	CPT-04D	CPT-04S	CPT-04S	CPT-16DD	CPT-18D	ءا	Т	T			CPT-21S	

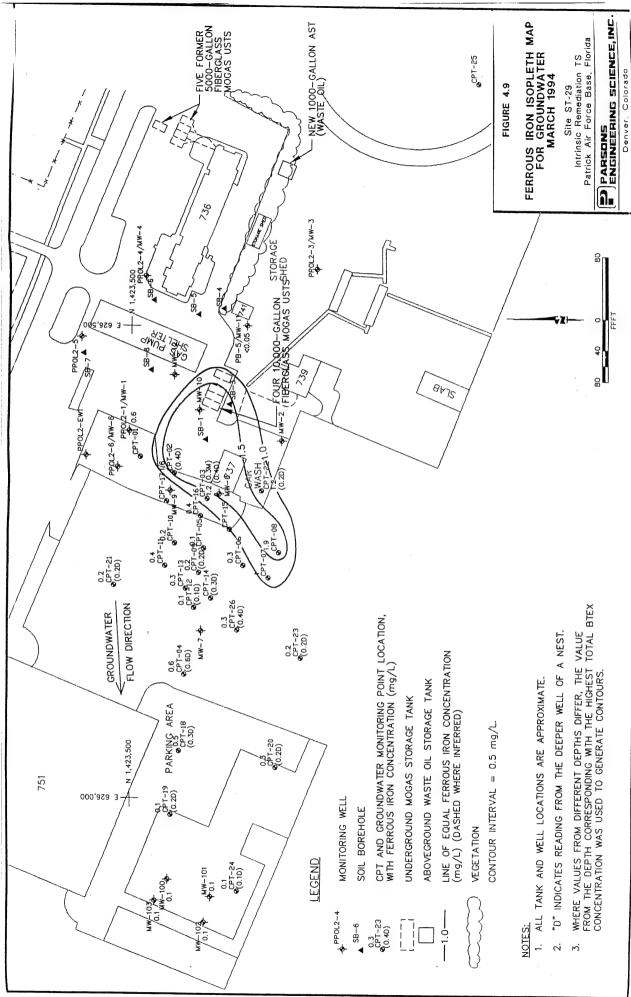
a/ NA = Data not available.



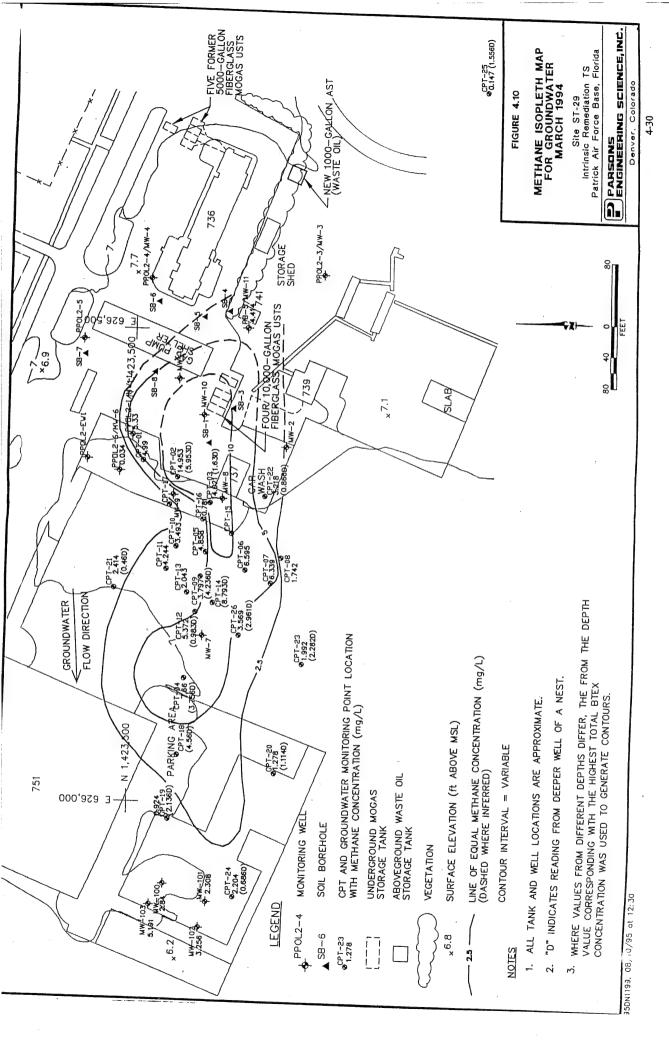
950N1196, 08/10/95 at 11:00

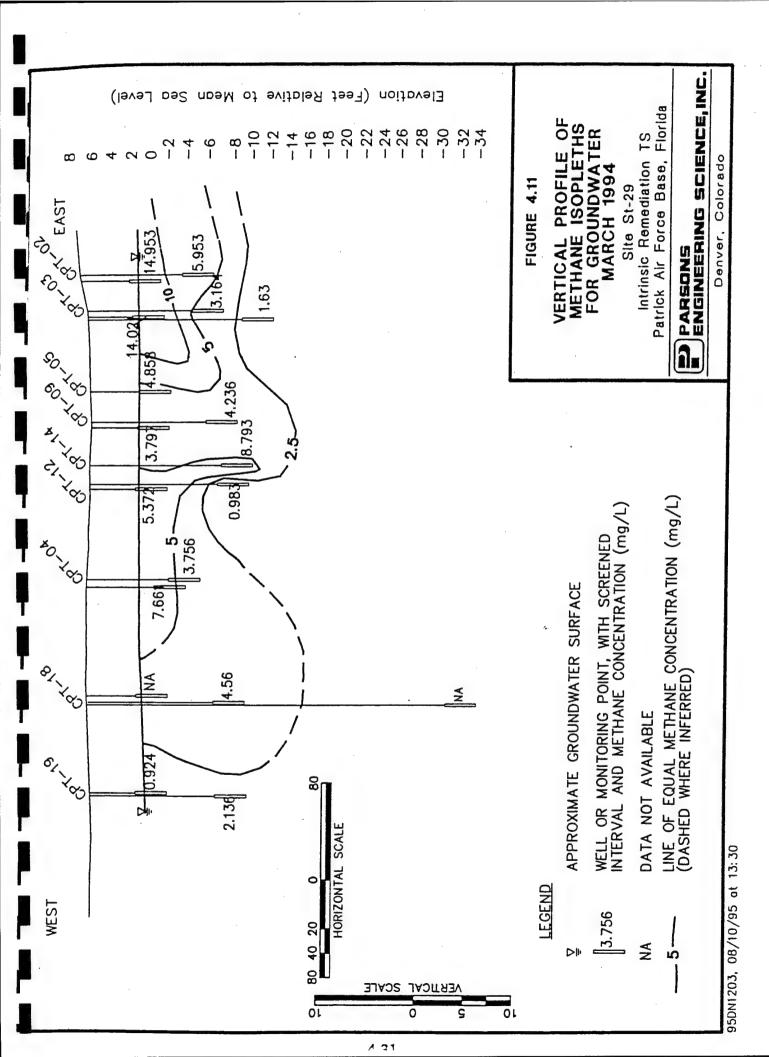


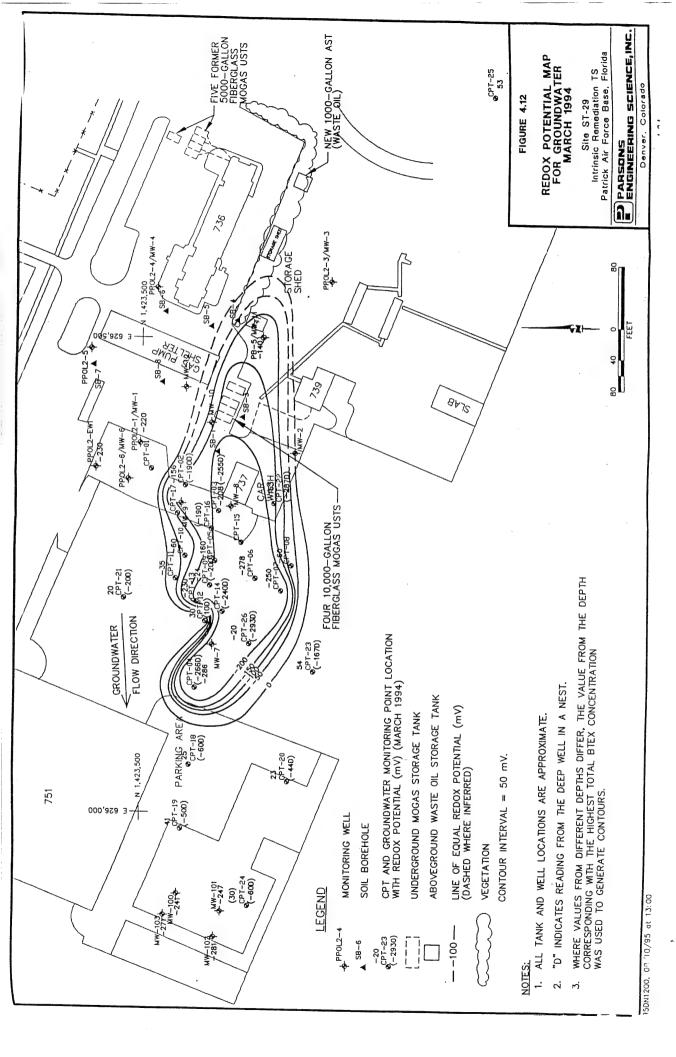




95DN1198, 08/10/95 at 12:15







APPENDIX B
LABORATORY ANALYTICAL RESULTS

DESCRIPTION ASSAULT

ENVIRONMENTAL

REFERRING CLIENT

Account: 8185

Parsons Engineering/AFCEE Exte

Doug Scott

1700 Broadway Ste 900

Danver, CO 80290

U3U144

2960 Poster Creighton Drive



Numbrille, TN 37214 615 726-0177, 800-765 0980 FAX 615/726-3404

clalized Assays: (800) 765-0980

Ph: 303	-831-8100 Fax: 303-8:	31-8208		Spec	isl	ized Assays: (800) 765-0980
LING CONTROL NUMBER			PROJECT 726	876.	27	122 726876,27122
Mi Signature Plase P			PROJECT	NAME	BXS	SERVICE STATION (PA1), 6, PATRICK RFB
FC LAB USE ONLY	SAMPLE DESCRIPTION	DATE	TIME	COMP	100 B	ANALYSIS REQUESTED
3 388630	PA1-581-3	7/27/98	1345		1	FL-PRO(TRPH), SW8020, SW8310
8-A88631	PA1-582-3	7/27/78	1425		1	FL-PRO(TRPH), SW8020, SW8310
8-A88632	PA1-583-3	7/27/98	440		1	FL-PRO(TRPH); SW8020, SW8310
;e - 488633	PA1-584-3	7/27/18	1500		1	FL-PRO(TRPH), SW8020, SW8310
°E 488634	PA1-5B5-3	7/27/98	153ª		1	FL-PROCTRPHD, SW8020) SW8310
7E 488435	PA1-586-3	7/27/98	1555		1	FL-PROCTRPHISW8020, SW8310
7 - A88636	PA1-5B7-3	7/27/48	1615		1	FL-PRO(TRPH), SW8020, SW8310
8-A88428	PA1-EQPBLK	7/27/98	1410		2	SW8020
78-A88637	PA1-DUP1	7/27/98	3		1	FL-PROCTRPH, SW8020, SW8310
	Jug	licate of	SBI	/	1	Laboratory by: , Date / Time
Live (what	Date / Time Received by: (5				P)	194/38 (21m)
Latinguisticd by (Signature) Latinguished by (Signature)	Date / Turns Received by: (3					
Z Lished by: (Signature)	Date / Time Received by (Signature)		-	Al Pos	wei #:

or further assistance in completing the chain of custody form please refer to the instructions found on the opposite si

1A- U3U134

ENVIRONMENTAL

REFERRING CLIENT

Account: 8185

Pursons Engineering/AFCEE Exte

Doug Scott

1700 Broadway Ste 900

Uanver, CO 80290

Ph: 303-831-8100 Fax: 303-831-8208

08-03-98 02:15PM FROM PARSONS ENGINEERING



2960 Foster Craighton Orivo Nushvillo, TN 37264 at5 726 0177, RKE-765-0980 FAX 615/726-3404

Specialized Assays: (800) 765-0980

-0200									
	726	87	16.	27	726876,27122				
We (White - STEVE ARCHABAL				PROJECT NAME BY SERVICE STATION (PA1) FACILITY 736, PATRICK AFB					
DATE	TIME	COMP	OKAB	V00 Ø 1	ANALYSIS REQUESTED				
1/2.8/98	0820		Χ	1	FL-PRO(TRPH), SW8020, SW8310				
1/28/98	0835		X	1	FL-PRO(TRPH), SW8020, SW8310				
1/28/98	0850		X	1	FL-PROCTRPH), SW8020, SW8310				
1/28/18	0905		X		FL-PROCTRPH), SW 8020, SW 8310				
1/28/98	0935		X	l	FL-PRO(TRPH),SW8020, SW8310				
1/28/98	0950		Χ	ļ	FL-PROCTRPH), SW 8020, SW 8310				
1			X	1	FL-PROGRAPH)SW8020, SW8310				
7/28/98	1020		X	1	FL-PRO(TRPH), SW8020, SW8310				
7/28/98			X	1	FL-PROCTRAN, SW8020, SW8310				
duplicate	öfsp	15	TILR		SW8020				
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routurther assistance in completing the chain of custody form please refer to the instructions found on the opposite side



SPECIALIZED ASSAYS INC. • 2960 Foster Creighton Dr. • P.O. Box 40566 • Nashville, Tennessee 37204-0566

615-726-0177 • 1-800-765-0980 • Fax 615-726-3404

CASE NARRATIVE

Reco 78

Client: Parsons Engineering Science (8185)

Attn: Lynnea Peterson 1700 Broadway Suite 900 Denver, CO 80290 (303)-831-8100

Client Project: 726876.27122

Matrix: Soil/Water

Laboratory Project: 108315

Number samples: 17/2

Date Received: 07/29/98

Analytical Methods: SW846 8021B

SW846 8310 FLA PRO

Sample Receipt Notes: All samples were received in good condition and properly preserved. There were no anomalies noted at sample login.

QC Notes: Volatile Organics by 8021B – The Trip blank required a second analysis due to poor internal and surrogate standard recovery from the initial purge. On re-analysis, all sample specific QC parameters were within acceptable limits. Two soil samples, PA1-SB2-3 and PA1-DUP1, required analysis on a 5-fold dilution due to purge efficiency issues with the matrix. The original 5.0-gram purge did not show any recovery for the internal and surrogate standards. These parameters were within acceptable limits on the diluted analysis. The soil matrix spike/spike duplicate sample was PA1-SB11-3.

PAH by 8310 – Sample PA1-DUP2 was used for MS/MSD. The percent recovery for the Acenaphthene on the Spike duplicate was below acceptance limits at 36 % recovery (lower limit = 43%), and nine of the PAH compounds had RPD's above QC limits. All compounds showed acceptable recovery on the laboratory control spike.

FLA PRO – All QC parameters were within method or laboratory acceptance limits. Sample PA1-DUP2 was used for matrix spike/spike duplicate analysis.

If you have any questions as you review this package, please call me at 1-800-7650-980.

Thanks

Johnny A. Mitchell

Director of Technical Services



615-726-0177 • 1-800-765-0980 • Fax 615-726-3404

SPECIALIZED ASSAYS

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2960 Foster Creighton Dr. P.O. Box 40566 Nashville, TN 37204-0566 Phone 1-615-726-0177

PA1-EQPBLK

Matrix: Water

pH:

Units: ug/l

Dilution Factor: 1.

Analysis Method: SW80218 Delivery Group: 108315

Instrument:

Lab Sample ID: 98-A88628
Date Sampled:: 7/27/98
Date Received: 7/29/98
Analysis Date: 8/ 4/98
Analysis Time: 20:54

Sample Identification

Sample QC Group: 6063

FORM I

CAS NUMBER	ANALYTE	CONCENTRATI	ON FLAG
•			
71-43-2	Benzene	2.0	J
	Chlorobenzene		U
	1,2-Dichlorobenzene		U
	1,3-Dichlorobenzene		U
106-46-7	1,4-Dichlorobenzene	3.0	U
100-41-4	Ethylbenzene	2.0	U
	Toluene		U
108-38-3	m, p-Xylenes	2.0	U
95-47-6	o-Xylene	2.0	U
1634-04-4	MTBE	2.0	U

17



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Sample Identification

TRIP BLANK

Matrix: Water

pH:

Units: ug/l

Dilution Factor: 1.

Analysis Method: SW8021B Delivery Group: 108315

Instrument:

Lab Sample ID: 98-A88629

Date Sampled::

Date Received: 7/29/98 Analysis Date: 8/5/98

Analysis Time: 21:31 Sample QC Group: 6063

CAS NUMBER	ANALYTE	CONCE	ENTRATIO)N F	LAG
108-90-7	Benzene Chlorobenzene 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene Ethylbenzene Toluene m,p-Xylenes	• • • • • • • • • • • • • • • • • • • •	2. 0 2. 0 4. 0 4. 0 3. 0 2. 0 2. 0 2. 0		U U U U U U U
95-47-6	o-Xylene		2. 0 2. 0		



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Matrix: Soil % Dry Weight:

96.

Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8021B Delivery Group: 108315

Instrument: T9001B

Sample Identification

PA1-SB1-3

Lab Sample ID: 98-A88630

Date Sampled:

7/27/98

Date Received:

7/29/98 7/31/98

Analysis Date:

Analysis Time: 23:47 Sample QC Group: 1360

CAS NUMBER	ANALYTE	CONC	ENTRAT	ION	FLAG
71-43-2	. Benzene	• • •	1. 0		. ↔
108-90-7	.Chlorobenzene		2. 1		. U
95-50-1	.1,2-Dichlorobenzene		4. 2		. U
541-73-1	.1,3-Dichlorobenzene		4. 2		. U
106-46-7	. 1,4-Dichlorobenzene		3. 1		. U
100-41-4	.Ethylbenzene		2. 1		. U
1.08-88-3	.Toluene		2. 1		. U
108-38-3	.m,p-Xylenes		2. 1		. U
	.o-Xylene		2. 1		. U
	MTBE		2. 1		. U

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PA1-SB2-3

Matrix: Soil % Dry Weight: 96. Units: ug/kg dry weight

Dilution Factor: 5.

Analysis Method: SW8021B Delivery Group: 108315

Instrument: T9001B

Lab Sample ID: 98-A88631 Date Sampled: 7/27/98 7/29/98 Date Received: Analysis Date: 8/ 2/98 Analysis Time: 16:42 Sample QC Group: 1360

Sample Identification

CAS NUMBER	ANALYTE	CONCE	NTRATIO	DN F	FLAG
71-43-2	Benzene		5. 2		4
	Chlorobenzene		10. 4		U
95-50-1	1,2-Dichlorobenzene		20.8		U
	1,3-Dichlorobenzene		20.8		U
106-46-7	1,4-Dichlorobenzene		15. 6		U
100-41-4	Ethylbenzene		10. 4		U
	Toluene		10. 4		U
108-38-3	m, p-Xylenes		10. 4		U
	o-Xylene		10.4		U
1634-04-4	MTBE		10.4		U

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Matrix: Soil

% Dry Weight: 97. Units: ug/kg dry weight

Dilution Factor: 1. Analysis Method: SW8021B Delivery Group: 108315

Instrument: T9001B

Sample Identification

PA1-SB3-3

Lab Sample ID: 98-A88632

Date Sampled:

7/27/98

Date Received: Analysis Date:

7/29/98 8/ 1/98

Analysis Time:

1:00

Sample QC Group: 1360

CAS NUMBER ANALYTE CONCENTRATION FLAG 71-43-2 Benzene 1.0 U 108-90-7 Chlorobenzene 2.1 U 95-50-1 1,2-Dichlorobenzene 4.1 U 541-73-1 1,3-Dichlorobenzene 4.1 U 106-46-7 1,4-Dichlorobenzene 3.1 U 100-41-4 Ethylbenzene 2.1 U 108-88-3 Toluene 2.1 U 108-38-3 m, p-Xylenes 2.1 U 95-47-6 0-Xylene 2.1 U 1634-04-4 MTBE 2.1 U						
108-90-7 Chlorobenzene 2.1 U 95-50-1 1,2-Dichlorobenzene 4.1 U 541-73-1 1,3-Dichlorobenzene 4.1 U 106-46-7 1,4-Dichlorobenzene 3.1 U 100-41-4 Ethylbenzene 2.1 U 108-88-3 Toluene 2.1 U 108-38-3 m,p-Xylenes 2.1 U 95-47-6 0-Xylene 2.1 U	CAS NUMBER	ANALYTE	CONCI	ENTRATI	ON	FLAG
108-88-3 Toluene	108-90-7	Chlorobenzene	• •	2. 1 4. 1 4. 1 3. 1		. U . U . U
	108-88-3 108-38-3 95-47-6	Toluene	• •	2. 1 2. 1 2. 1		. U



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PA1-SB4-3

Matrix: Soil % Dry Weight:

96.

Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8021B Delivery Group: 108315

Instrument: T9001B

Lab Sample ID: 98-A88633

Sample Identification

Date Sampled:

7/27/98

Date Received:

7/29/98

Analysis Date:

Analysis Time:

8/ 1/98

1:36

Sample QC Group: 1360

CAS NUMBER	ANALYTE	CONCENTRATIO	ON FLAG
71-43-2	Benzene	1.0	U_
108-90-7	Chlorobenzene	2.1	U
95-50-1	1,2-Dichlorobenzene	4.2	U
541-73-1	1,3-Dichlorobenzene	4.2	U
106-46-7	1,4-Dichlorobenzene	3. 1	U
100-41-4	Ethylbenzene	2.1	υ
	Toluene		U
	m, p-Xylenes		U
	o-Xylene		U
	MTBE		U



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PA1-SB5-3

Matrix: Soil % Dry Weight: 94.

Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8021B

Delivery Group: 108315

Instrument: T9001B

Lab Sample ID: 98-A88634 7/27/98 Date Sampled: 7/29/98 Date Received: 8/ 1/98 Analysis Date: 2:13 Analysis Time:

Sample Identification

Sample GC Group: 1360

			_	
CAS NUMBER	ANALYTE	CON	CENTRAT	ION FLAG
71-43-2	Benzene		1. 1	. U
	Chlorobenzene		2. 1	U
	1,2-Dichlorobenzene		4. 3	U
	1,3-Dichlorobenzene		4. 3	U
106-46-7	1,4-Dichlorobenzene		3. 2	U
100-41-4	Ethylbenzene		2. 1	U
	Toluene		2. 1	U
	m, p-Xylenes		2. 1	U
	o-Xylene		2. 1	U
	MTBE		2. 1	U



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Matrix: Soil

% Dry Weight: 93. Units: ug/kg dry weight

Sample Identification

PA1-SB6-3

Lab Sample ID: 98-A88635 Date Sampled: 7/27/98 Date Received: 7/29/98

 CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
71-43-2	Benzene	1.1	. U
108-90-7	Chlorobenzene	2.2	. U
95-50-1	1,2-Dichlorobenzene	4.3	. U
541-73-1	1,3-Dichlorobenzene	4.3	. U
106-46-7	1,4-Dichlorobenzene	3. 2	. ₩
100-41-4	Ethylbenzene	2. 2	. U
108-88-3	Toluene	2.2	. υ
108-38-3	m,p-Xylenes	2.2	. U
95-47-6	o-Xylene	2.2	. υ
1634-04-4	MTBE	2.2	. υ



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Matrix: Soil

% Dry Weight: Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8021B

Delivery Group: 108315

Instrument: T9001B

Sample Identification

PA1-SB7-3

Lab Sample ID: 98-A88636

Date Sampled: 7/27/98

7/29/98

Date Received:

8/ 1/98

Analysis Date: Analysis Time:

3:26

Sample QC Group: 1360

CAS NUMBER	ANALYTE	CONC	ENTRATI	DN	FLAG
71-43-2	. Benzene		1. 0		. 😶
	. Chlorobenzene		2. 1		. U
95-50-1	. 1, 2-Dichlorobenzene		4. 2		. U
541-73-1	. 1,3-Dichlorobenzene		4. 2		. U
106-46-7	1,4-Dichlorobenzene		3. 1		. υ
100-41-4	Ethylbenzene		2. 1		. υ
108-88-3	Toluene		2. 1		. U
108-38-3	.m,p-Xylenes		2. 1		. υ
95-47-6	o-Xylene		2. 1		U
1634-04-4	MTBE		2. 1		. U



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PA1-DUP1

Matrix: Soil 90. % Dry Weight: Units: ug/kg dry weight

Dilution Factor: 5.

Analysis Method: SW8021B Delivery Group: 108315

Instrument: T9001B

Lab Sample ID: 98-A88637 Date Sampled: 7/27/98 7/29/98 Date Received: Analysis Date: 8/ 2/98 Analysis Time: 17:19 Sample QC Group: 1360

Sample Identification

	The state of the s			
CAS NUMBER	ANALYTE	CONCE	ENTRATION	FLAG
	Benzene			U
95-50-1	.1,2-Dichlorobenzene		22.2	U
	.1,3-Dichlorobenzene .1,4-Dichlorobenzene			U
100-41-4	Ethylbenzene		11.1	U
	.Toluene			U
95-47-6	o-Xylene			U
1634-04-4	. MTBE		11.1	U



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PA1-SB8-3

Matrix: Soil % Dry Weight: 98.

Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SW8021B Delivery Group: 108315

Instrument: T9001B

Lab Sample ID: 98-A88638
Date Sampled: 7/28/98
Date Received: 7/29/98
Analysis Date: 8/ 1/98
Analysis Time: 4:39

Sample Identification

Sample QC Group: 1360

CAS NUMBER	ANALYTE	CONC	ENTRATIO	I NC	FLAG
71-43-2	. Benzene		1. 0		ريد.
108-90-7	.Chlorobenzene		2. 0		U
95-50-1	.1,2-Dichlorobenzene	• •	4. 1		U
541-73-1	.1,3-Dichlorobenzene		4. 1		U
106-46-7	. 1,4-Dichlorobenzene		3. 1		U
100-41-4	Ethylbenzene		2. 0		U
	. Toluene		2. 0		U
	.m,p-Xylenes		2. 0		U
	.o-Xylene		2. 0		U
	MTBE		2. 0		U



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PA1-SB9-3

Matrix: Soil

% Dry Weight:

96.

Units: ug/kg dry weight

Lab Sample ID: 98-A88639 Date Sampled: 7/28/98 Date Received: 7/29/98

Sample Identification

CAS NUMBER	ANALYTE	CONCENTRA	TION FLAG
71-43-2	. Benzene	1.0	U
108-90-7	. Chlorobenzene	2. 1	U
95-50-1	.1,2-Dichlorobenzene	4. 2	U
541-73-1	.1,3-Dichlorobenzene	4.2	U
106-46-7	. 1, 4-Dichlorobenzene	3. i	· U
100-41-4	. Ethylbenzene	2. 1	U
108-88-3	. Toluene	1.1	J
108-38-3	.m,p-Xylenes	3. 4	
95-47-6	. o-Xylene	1. 1	J
	. MTBE		U

2960 Foster Creighton Dr. P.O. Box 40566 Nashville, TN 37204-0566 Phone 1-615-726-0177

PA1-SB10-3

Matrix: Soil % Dry Weight: 98.

Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8021B

Delivery Group: 108315

Instrument: T9001B

Lab Sample ID: 98-A88640 Date Sampled: 7/28/98 7/29/98 Date Received: 8/ 1/98 Analysis Date: Analysis Time: 6: 28

Sample Identification

Sample QC Group: 1360

FORM I

	CAS NUMBER	ANALYTE	CONCENT	RATION	FLAG
	71-43-2	. Benzene	1.0		
	108-90-7	. Chlorobenzene	2.0		. U
	95-50-1	. 1,2-Dichlorobenzene	4. 1		. U
	541-73-1	. 1,3-Dichlorobenzene	4. 1		. U
	106-46-7	. 1,4-Dichlorobenzene	3. 1		. U
	100-41-4	Ethylbenzene	2.0		. U
		.Toluene			. U
	108-38-3	.m,p-Xylenes	1. 3	3	. J
		.o-Xylene			. U
•	1634-04-4	MTBE	2.0) . <i>.</i> .	. U

A059 4

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PA1-SB11-3

Matrix: Soil

% Dry Weight: 98. Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8021B Delivery Group: 108315

Instrument: T9001B

Lab Sample ID: 98-A88641
Date Sampled: 7/28/98
Date Received: 7/29/98
Analysis Date: 8/ 1/98
Analysis Time: 7:05

Sample Identification

Sample QC Group: 1360

CAS NUMBER ANALYTE	CONC	ENTRATI	ON FLAG
71-43-2 Benzene		1. 0	. U
108-90-7 Chlorobenzene		2. 0	U
95-50-1		4. 1	U
541-73-1		4. 1	U
106-46-7		3. 1	U
100-41-4 Ethylbenzene		2. 0	U
108-88-3 Toluene		2.0	U
108-38-3m, p-Xylenes		2. 3	
95-47-6o-Xylene		2.0	U
1634-04-4 MTBE		2.0	υ



2960 Foster Creighton Dr. P.O. Box 40566 Nashville, TN 37204-0566 Phone 1-615-726-0177

Sample Identification

PA1-SB12-3

Matrix: Soil

% Dry Weight: 96. Units: ug/kg dry weight Lab Sample ID: 98-A88642 Date Sampled: 7/28/98

Date Received: 7/29/98

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
71-43-2	Benzene		U
108-90-7	Chlorobenzene	2.1	U
95-50-1	1,2-Dichlorobenzene	4.2	U
541-73-1	1,3-Dichlorobenzene	4.2	U
	1,4-Dichlorobenzene		せ
	Ethylbenzene		U
	Toluene		U
	m, p-Xylenes		U
	o-Xylene		U
	MTBE		U



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Matrix: Soil

% Dry Weight: 97. Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8021B Delivery Group: 108315

Instrument: T9001B

Sample Identification

PA1-SB13-3

Lab Sample ID: 98-A88643 Date Sampled: 7/28/98

Date Received: 7/29/98 Analysis Date: 8/ 1/98

Analysis Time: 8:18 Sample QC Group: 1360

 CAS NUMBER	ANALYTE	CONC	ENTRATI	ON F	LAG
71-43-2	. Benzene		1. 0		₩.
108-90-7	.Chlorobenzene		2. 1		U
95-50-1	. 1,2-Dichlorobenzene		4. 1		U
541-73-1	. 1,3-Dichlorobenzene		4. 1		U
106-46-7	. 1, 4-Dichlorobenzene		3. 1		U
100-41-4	. Ethylbenzene		2. 1		U
	.Toluene		2. 1		U
	.m,p-Xylenes		2. 1		U
	.o-Xylene		2.1.		U
	MTBE		2. 1		U



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PA1-SB14-3

Matrix: Soil

% Dry Weight: 91. Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8021B Delivery Group: 108315

Instrument: T9001B

Lab Sample ID: 98-A88644
Date Sampled: 7/28/98
Date Received: 7/29/98
Analysis Date: 8/ 1/98
Analysis Time: 8:55

Sample Identification

Sample QC Group: 1360

FORM I

CAS NUMBER ANALYTE	CONCENTRATION FLAG
71-43-2 Benzene	1.1 · +
108-90-7 Chlorobenzene	2.2 U
95-50-1	4.4 U
541-73-1	4.4 U
106-46-7	
100-41-4 Ethylbenzene	2.2 U
108-88-3 Tolvene	
108-38-3m, p-Xylenes	
95-47-6o-Xylene	
1634-04-4 MTBE	



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PA1-SB15-3

Matrix: Soil

% Dry Weight: 94. Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8021B Delivery Group: 108315

Instrument: T9001B

Lab Sample ID: 98-A88645
Date Sampled: 7/28/98
Date Received: 7/29/98
Analysis Date: 8/ 1/98
Analysis Time: 9:31
Sample QC Group: 1360

Sample Identification

FORM I

	·			
 CAS NUMBER	ANALYTE	CONCE	NTRATIO	N FLAG
71-43-2	. Benzene		1. 1	U
108-90-7	. Chlorobenzene		2. 1	U
	.1,2-Dichlorobenzene		4. 3	U
541-73-1	.1,3-Dichlorobenzene		4. 3	U
106-46-7	1,4-Dichlorobenzene		3. 2	U
100-41-4	Ethylbenzene		18. 5	
	Toluene		1. 1	J
	.m,p-Xylenes		5. 7	
	. o-Xylene		4. 8	
	. MTBE		2. 1	U

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Matrix: Soil

% Dry Weight: 94.

Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SW8021B

Delivery Group: 108315

Instrument: T9001B

Sample Identification

PA1-DUP2

Lab Sample ID: 98-A88646

Date Sampled: 7/28/98 Date Received: 7/29/98

Analysis Date: 8/ 1/98 Analysis Time: 10:08

Sample QC Group: 1360

CAS NUMBER	ANALYTE	CONCE	ENTRATIO)N	FLAG
71-43-2	. Benzene		1. 1		. 4
	Chlorobenzene		2. 1		. U
	1,2-Dichlorobenzene		4. 3		. U
541-73-1	1,3-Dichlorobenzene		4. 3		. U
	1,4-Dichlorobenzene		3. 2		. U
	Ethylbenzene		18. 2		•
	Toluene		1.3		. J
108-38-3	m,p-Xylenes		6.0		
95-47-6	o-Xylene		5. 1		•
1634-04-4	MTBE		2. 1		. U

Soil PATER VOLATILE SYSTEM MONITORING COMPOUND RECOVERY

Lab Name:	SPECIALIZED ASSA	YS		Laboratory Code: SASSA	YS	
SDG:	108315B	•	Site:	Location:	Group:	-

		SMC1	CHOO	C) 400	1 01 101	1
	SAMPLE NO.	SMC1	SMC2	SMC3	SMC4	TOT
01	VBLK01	96		#	#	
02		86	83	101		0
03		0 #	77	100		0
04	PA1-SB3-3	94	0 #	0 #		3
05	PA1-SB4-3	89	82	99		0
06	PA1-SB5-3	89	82 84	99		0
07	PA1-SB6-3	87	82	100		0
08	PA1-SB7-3	90	83	100		0
09	PA1-DUP1	0 #	0 #	0 #		0
10	PA1-SB8-3	88	79	100		3
11	PA1-SB9-3	95	87	100		0
12	PA1-SB10-3	91	81	99		0
13	PA1-SB11-3	88	82	101		0
14	PA1-SB12-3	88	77	97		0
15	PA1-SB13-3	92	85	99		0
16	PA1-SB14-3	91	84	100		0
17	PA1-SB15-3	93	79	93		0
18	PA1-DUP2	90	77	99		0
19	PA1-SB11-3MS	96	93	101		0
20	PA1-SB11-3MSD	95	90	100	· · · · · · · · · · · · · · · · · · ·	0
21	CONTROLS01	98	96	101		0
22	VBLK02	93	84	102		0
23[PA1-SB2-3 RE	86	77	100		0
24	PA1-DUP1 RE	94	87	100		0
25				2-		
26						
27						\neg
28						
29						
30						

SMC1 = Chloroprene

SMC2 = Chloro-3-fluorobenzene

SMC3 = a,a,a-Trifluorotoluene

QCLIMITS

(64-130)

(65-132)

(70-130)

- # Column to be used to flag recovery values
- * Values outside of contract required QC limits
- D System Monitoring Compound diluted out

FORM II VOA-1

3/90

FORM 3B

VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab: Specialized Assays, Inc.

Project: BX SERVCIE STATION (FA1)

Matrix Spike Sample: PA1-SB11-3

SDG: 108315

CC Group: 1360

Compound	Spike Added 	Sample Conc	Spike Conc	% Rec	QC Limits	
Benzene	20.4	0.0	20.0	78	81 - 114	
Toluene	20.4	0.0	20.1	78	81 - 116	
m,p-Xylenes	40.8	2.3	41.1	75	83 - 121	

Spike Added	MSD Conc	% Rec	RPD	RPD Limit	Recovery Limits
20.4	20.0	98	0	18	81 - 114
20.4	20.2	99	1	18	81 - 116
40.8	41.4	96	1	18	83 - 121
	Added 20.4 20.4	Added Conc 20.4 20.4 20.2	Added Conc % Rec 70.4 20.0 98 20.4 20.2 99	Added Conc % Rec RFD 20.4 20.0 98 0 20.4 20.2 99 1	Added Conc % Rec RPD Limit 20.4 20.0 98 0 18 20.4 20.2 99 1 18

Concentration Units: ug/kg

RPD: 0 out of 3 outside QC limits.

Spike Recoveries: 0 out of 6 outside QC limits.

FORM 3Ba

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc.

Project: BX SERVCIE STATION (FA1)

SDG: 108315

QC Group: 1360

Compound	Known Value 	Conc	% Rec	QC Limits
Benzene	20	20	100	74-130
Chlorobenzene	20	20.5	102	67-120
1,2-Dichlorobenzene	20	18.6	93	77-128
1,3-Dichlorobenzene	20	18.5	92	80-127
1,4-Dichlorobenzene	20	17.8	89	77-128
Ethylbenzene	20	20.2	101	70-120
Toluene-	20	20.5	102	70-134
m,p-Xylenes	40	41.7	104	65-131
o-Xylene	50	20.9	104	65-129
MTBE	20	18.5	92	70-128

Concentrátion Units: ug/kg

Recoveries: 0 out of 10 outside QC limits.

VOLATILE METHOD BLANK SUMMARY

SAMPLE NO.

Lab Name:	SPECIALIZED ASSA	iys	Contract:		VBLK01	
SDG:	108315B	Group:	<u>.</u>	Site:	Location:	-
Lab File ID:				Date Analyzed:	7/31/98	
Instrument ID	D:			Time Analyzed:	2310	
GC Column:	DB-VRX	ID: 0.45 ((mm)	Heated Purge:	(Y/N) <u>Y</u>	

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS, AND MSD:

		LAB	LAB	TIME
	SAMPLE NO.	SAMPLE I.D.	FILE I.D.	ANALYZED
	PA1-SB1-3	88630	073198TB.004	23:47
	PA1-SB2-3	88631	073198TB.005	0:23
03	PA1-SB3-3	88632	073198TB.006	1:00
04	PA1-SB4-3	88633	073198TB.007	1:36
	PA1-SB5-3	88634	073198TB.008	2:13
06	PA1-SB6-3	88635	073198TB.009	2:49
07	PA1-SB7-3	88636	073198TB.010	3:26
08	PA1-DUP1	88637	073198TB.011	4:02
09	PA1-SB8-3	88638	073198TB.012	4:39
10	PA1-SB9-3	88639	073198TB.014	5:52
	PA1-SB10-3	88640	073198TB.015	6:28
12	PA1-SB11-3	88641	073198TB.016	7:05
13	PA1-SB12-3	88642	073198TB.017	7:42
14	PA1-SB13-3	88643	073198TB.018	8:18
	PA1-SB14-3	88644	073198TB.019	8:55
16	PA1-SB15-3	88645	073198TB.020	9:31
17	PA1-DUP2	88646	073198TB.021	10:08
18	PA1-SB11-3MS	MS88641	073198TB.022	10:44
19	PA1-SB11-3MSD	MSD88641	073198TB.023	11:21
20	CONTROLS01	LCS	073198TB.024	11:57
21				
22			***************************************	
23				
24				
25				
26				
27				
28			-	
29				
30				

COMMENTS:				
	 		· · · · · · · · · · · · · · · · · · ·	

FORM IV VOA

4A VOLATILE METHOD BLANK SUMMARY

SAMPLE NO.

Lab Name:	SPECIALIZED ASSAY	'S	Contract:		VBLK02	
SDG:	108315B	Group:	_	Site:	Location:	
Lab File ID:				Date Analyzed	: 8/2/98	
Instrument ID):			Time Analyzed	1606	
GC Column:	DB-VRX	ID: <u>0.45</u> (n	nm)	Heated Purge:	(Y/N) Y	

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS, AND MSD:

	SAMPLE NO.	LAB SAMPLE I.D.	LAB FILE I.D.	TIME ANALYZED
01 PA	1-SB2-3 RE	88631B	080298TB.004	16:42
02 PA	1-DUP1 RE	88637B	080298TB.005	17:19
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20			-	
21				
22				
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25				
26				
27				
28				
29				
30				

COMMENTS:	

FORM IV VOA

6A VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: Specialized Assays			Lab Code	e:	SASSAYS	6		
SGD: 108315B	Site	-		Location		_	Group	
Instrument ID:		Calibration	- on Date(s):	7/30/98		-		
Heated Purge: (Y/N) Y				1717		-		
GC Column: DB-VRX	ID:	0.45					•	
Lab File ID: RRF1.2= 073098TB.		RRF4=	073098TE	3.004	RRF12=	073098T	B.005	
RRF20= 073098TB.	006	RRF32=	073098TE	3.007	RRF40=	073098T	B.008	
COMPOUND	RRF1.2	RRF4	RRF12	RRF20	RRF32	RRF40	RRF	% RSD
Benzene	0.403	0.491	0.441	0.456	0.445	0.442	0.446	6.3
Toluene	0.524	0.498	0.427	0.425	0.405	0.399	0.446	11.6
Ethylbenzene	0.379	0.416	0.364	0.362	0.346	0.336	0.367	7.7
m,p-Xylene	0.460	0.473	0.381	0.354	0.317	0.298	0.381	19.1
o-Xylene	0.400	0.427	0.355	0.337	0.303	0.286	0.351	15.5
MTBE	0.149	0.193	0.180	0.193	0.185	0.191	0.182	9.3
Chlorobenzene	0.410	0.458	0.404	0.405	0.381	0.367	0.404	7.7
1.2-Dichlorobenzene	0.235	0.266	0.239	0.238	0.221	0.215	0.236	7.5
1.3-Dichlorobenzene	0.406	0.405	0.339	0.328	0.300	0.281	0.343	15.3
1.4-Dichlorobenzene	0.324	0.338	0.287	0.281	0.262	0.250	0.290	11.9
							0.200	11.5
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Page 1 of 1

^{*} Compounds with required minimum RRF and maximum %RSD values. All other compounds must meet a minimum RRF of 0.010.

Lab Name:	SPECIALIZED ASSA	YS	Lab Code:	SASSAYS				
SDG:	108315B	Site:		Location:		Group:		
instrument if	D:		Calibration Date:	7/31/98		Time:	2233	_
Lab File ID:	073198TB.002		Init. Calib. Date(s):	7/30/98	7/30/98			
Heated Purg	e: (Y/N)Y		Init. Calib. Times:	1717	2022			
GC Column:	DB-VRX	ID:	0.45 (mm)					

COMPOUND	TRUE	ACTUAL	% REC	LIMI
Benzene	20.000	20.200	101	80-1
Toluene	20.000	21.000	105	80-1
Ethylbenzene	20.000	21.200	106	80-1
m,p-Xylene	40.000	44.400	111	80-1
o-Xylene	20.000	21.800	109	80-1
Chlorobenzene	20.000	21.700	109	80-1
1,2-Dichlorobenzene	20.000	22.200	111	80-1
1,3-Dichlorobenzene	20.000	22.500	113	80-1
1.4-Dichlorobenzene	20.000	23.200	116	80-1
MTBE	20.000	18.300	92	80-1

Lab Name:	SPECIALIZED ASSA	YS	Lab Code:	SASSAYS				
SDG:	108315B	Site:		Location:		Group:		
instrument il	D:		Calibration Date:	8/1/98		Time:	0515	
Lab File ID:	073198TB.013		Init. Calib. Date(s):	7/30/98	7/30/98			
Heated Purg	ge: (Y/N) <u>Y</u>		Init. Calib. Times:	1717	2022			
GC Column:	DB-VRX	· ID:	0.45 (mm)					

	(11111)		1	
COMPONING			%	QC
COMPOUND	TRUE	ACTUAL	REC	LIMITS
Benzene	20.000	20.100	101	80-120
Toluene	20.000	20.700	104	80-120
Ethylbenzene	20.000	20.600	103	80-120
m,p-Xylene	40.000	42.900	107	80-120
o-Xylene	20.000	21.600	108	80-120
Chlorobenzene	20.000	21.000	105	80-120
1,2-Dichlorobenzene	20.000	19.900	100	80-120
1,3-Dichlorobenzene	20.000	19.000	95	80-120
1,4-Dichlorobenzene	20.000	19.700	99	80-120
MTBE	20.000	18.600	93	80-120
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		1		

Lab Name: S	PECIALIZED ASSA	YS	Lab Code:	SASSAYS			
SDG:	108315B	Site:		Location:		Group:	
Instrument ID:			Calibration Date:	8/1/98		Time: _	1311
Lab File ID:	073198TB.026		Init. Calib. Date(s):	7/30/98	7/30/98		
Heated Purge	: (Y/N) <u>Y</u>		Init. Calib. Times:	1717	2022		

ID: 0.45 (mm)

_			T		
				%	QC
	COMPOUND	TRUE	ACTUAL	REC	LIMITS
\Box	Benzene	20.000	19.500	98	80-120
	Toluene	20.000	20.100	101	80-120
	Ethylbenzene	20.000	19.900	100	80-120
Г	m,p-Xylene	40.000	41.000	103	80-120
Г	o-Xylene	20.000	20.500	103	80-120
	Chlorobenzene	20.000	20.100	101	80-120
Г	1,2-Dichlorobenzene	20.000	18.400	92	80-120
	1,3-Dichlorobenzene	20.000	17.400	87	80-120
	1,4-Dichlorobenzene	20.000	17.800	89	80-120
	MTBE	20.000	18.000	90	80-120
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GC Column:

DB-VRX

Lab Name:	SPECIALIZED ASSA	YS	Lab Code: SASSAYS		
SDG:	108315B	Site:	Location:	Group:	
Instrument I	D:		Calibration Date: 8/2/98	Time:	1529
Lab File ID:	080298TB.002		Init. Calib. Date(s): 7/30/98 7/30/98		
Heated Purg	ge: (Y/N) <u>Y</u>		Init. Calib. Times: 1717 2022		
GC Column	: DB-VRX	ID:	0.45 (mm)		

<u> </u>	(11111)	,		
		ļ	%	QC
COMPOUND	TRUE	ACTUAL	REC	LIMIT
Benzene	20.000	19.500	98	80-12
Toluene	20.000	20.300	102	80-12
Ethylbenzene	20.000	20.500	103	80-12
m,p-Xylene	40.000	43.200	108	80-12
o-Xylene	20.000	21.500	108	80-12
Chlorobenzene	20.000	20.900	105	80-12
1,2-Dichlorobenzene	20.000	22.000	110	80-12
1,3-Dichlorobenzene	20.000	20.600	103	80-12
1,4-Dichlorobenzene	20.000	21.400	107	80-12
MTBE	20.000	17.800	89	80-12
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Lab Name: Si	PECIALIZED ASSA	YS.	Lab Code:	SASSAYS				
SDG:	108315B	Site:		Location:		Group:_		_
Instrument ID:			Calibration Date:	8/2/98		Time:	2211	
Lab File ID:	080298TB.013		Init, Calib. Date(s):	7/30/98	7/30/98			
Heated Purge:	(Y/N) <u>Y</u>		Init. Calib. Times:	1717	2022			
GC Column:	DB-VRX	ID:	0.45 (mm)					

			%	QC
COMPOUND	TRUE	ACTUAL	REC	LIMITS
Benzene	20.000	19.300	97	80-120
Toluene	20.000	20.100	101	80-120
Ethylbenzene	20.000	20.200	101	80-120
m,p-Xylene	40.000	42.000	105	80-120
o-Xylene	20.000	21.400	107	80-120
Chlorobenzene	20.000	20.600	103	80-120
1,2-Dichlorobenzene	20.000	21.300	107	80-120
1,3-Dichlorobenzene	20.000	18.900	95	80-120
1,4-Dichlorobenzene	20.000	20.100	101	80-120
MTBE	20.000	18.600	93	80-120
				
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PA1-SB1-3

Matrix: Soil 96. % Dry Weight:

Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g

Extract Vol:

1.00 ml

Lab Sample ID: 98-A88630 7/27/98 Date Sampled: 7/29/98 Date Received: Analysis Date: 8/ 7/98

Sample Identification

Analysis Time: 20:16. Sample QC Group: 1116

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCEN	TRATIO	NC	FLA	₩G
	Naphthalene		1250		. ι	}
	Acenapthene		1250		. ι	3
	Anthracene		458		. ι)
	Fluoranthene		146		. ι	3
	Fluorene		146		. ι)
	Pyrene		188		. ι	,
	Benzo(a)anthracene		9. 4			
	Benzo(a)pyrene		16			
	Benzo(b)fluoranthene		12			
			11			
	Benzo(k)fluoranthene					
	Chrysene		104			
	Dibenzo(a,h)anthracene		21			
	Indeno(1,2,3-cd)pyrene		31		. t	J
	Acenapthylene		1600		. ι	3
	Benzo(g, h, i)perylene		52		. ι	j
	Phenanthrene		438		. L	j

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Sample Identification

PA1-SB2-3

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight
Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g Extract Vol: 1.00 ml Lab Sample ID: 98-A88631
Date Sampled: 7/27/98
Date Received: 7/29/98
Analysis Date: 8/ 7/98
Analysis Time: 20:53
Sample QC Group: 1116

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCENTRAT	ON FLAG
	Naphthalene	1250	U
	Acenapthene	1250	U
	Anthracene		U
	Fluoranthene	146	U
	Fluorene		U
	Pyrene		U
	Benzo(a)anthracene		U
	Benzo(a)pyrene		U
	Benzo(b)fluoranthene		U
	Benzo(k)fluoranthene		U
	Chrysene		U
	Dibenzo(a, h)anthracene .		U
	Indeno(1,2,3-cd)pyrene .		U
	Acenapthylene		U
			U
	Benzo(g, h, i)perylene		
	Phenanthrene	436	U

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Matrix: Soil

% Dry Weight: 97. Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g Extract Vol:

1.00 ml

Sample Identification

PA1-5B3-3

Lab Sample ID: 98-A88632 Date Sampled: 7/27/98

Date Received: 7/29/98 Analysis Date: 8/ 7/98

Analysis Time: 21:30 Sample QC Group: 1116

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCENTRAT	ION FLAG
	Naphthalene	1240	U
	Acenapthene	1240	U
			U
			U
			U
			U
			U
			U
	The state of the s		U
	Benzo(k)fluoranthene	11	U
			U
			U
			U
		· ·	
			Ū
			Ū
		Naphthalene Acenapthene Anthracene Fluoranthene Fluorene Pyrene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene Acenapthylene Benzo(g,h,i)perylene	Naphthalene

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PA1-SB4-3

Matrix: Soil % Dry Weight: 96. Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g Extract Vol: 1.00 ml Lab Sample ID: 98-A88633
Date Sampled: 7/27/98
Date Received: 7/29/98
Analysis Date: 8/ 7/98
Analysis Time: 22:07
Sample QC Group: 1116

Sample Identification

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCENTRATIO	N FLAG
	Naphthalene	1250	U
	Acenapthene	1250	U
	Anthracene		U
	Fluoranthene		U
	Fluorene		U
	Pyrene		U
	Benzo(a)anthracene		U
	Benzo(a)pyrene		U
	Benzo(b)fluoranthene		ū
	Benzo(k)fluoranthene		Ū
	Chrysene		U
•••••	Dibenzo(a, h)anthracene		Ü
			U
	Indeno(1,2,3-cd)pyrene		
	Acenapthylene		U
	Benzo(g, h, i)perylene		U
	Phenanthrene	438	U



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PA1-SB5-3

Matrix: Soil % Dry Weight: 94.

Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g Extract Vol: 1.00 ml Lab Sample ID: 98-A88634 7/27/98 Date Sampled: 7/29/98 Date Received: 8/ 7/98 Analysis Date: Analysis Time: 22:43 Sample QC Group: 1116

Sample Identification

8/ 3/98 Extraction Date:

CAS NUMBER	ANALYTE	CONCENTRATION FLAG
	Naphthalene	1280 U
	Acenapthene	
	Anthracene	
	Fluoranthene	
	Fluorene	4.45
	Pyrene	191 U
	Benzo(a)anthracene	
	Benzo(a)pyrene	16 U
	Benzo(b)fluoranthene	
	Benzo(k)fluoranthene	
	Chrysene	106 U
	Dibenzo(a, h)anthracene	
	Indeno(1,2,3-cd)pyrene	
	Acenapthylene	
	Benzo(g,h,i)perylene	
	Phenanthrene	

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Sample Identification

PA1-SB6-3

Matrix: Soil % Dry Weight: 93. Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g Extract Vol: 1.00 ml Lab Sample ID: 98-A88635 Date Sampled: 7/27/98 Date Received: 7/29/98 Analysis Date: 8/ 7/98 Analysis Time: 23:20 Sample QC Group: 1116

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCEN	TRATION	FLAG
	Naphthalene			U
	Acenapthene		1290	U
	Anthracene		473	U
	Fluoranthene		151	U
	Fluorene		151	U
	Pyrene		194	U
	Benzo(a)anthracene		9.7	U
	Benzo(a)pyrene		16	U
	Benzo(b)fluoranthene		13	U
	Benzo(k)fluoranthene		12	U
	Chrysene			U
	Dibenzo(a, h)anthracene .		22	U
	Indeno(1,2,3-cd)pyrene .		32	U
	Acenapthylene			U
	Benzo(g, h, i)perylene			U
	Phenanthrene		452	U

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Sample Identification

PA1-SB7-3

Matrix: Soil 96. % Dry Weight: Units: ug/kg dry weight

Dilution Factor: 1. Analysis Method: SW8310

Delivery Group:

Instrument: Grams Extracted: 30.0 q

Extract Vol:

1.00 ml

108315

Lab Sample ID: 98-A88636 Date Sampled: 7/27/98 7/29/98 Date Received: Analysis Date: 8/ 7/98

Analysis Time: 23:57 Sample QC Group: 1116

8/ 3/98 Extraction Date:

_	CAS NUMBER	ANALYTE	CONCE	NTRATI	DN F	LAG
		Naphthalene		1250		U
		Acenapthene		1250		U
		Anthracene		458		U
		Fluoranthene		146		U
		Fluorene		146		U
		Pyrene		188		U
		Benzo(a)anthracene		9.4		U
		Benzo(a)pyrene		16		U
		Benzo(b)fluoranthene		12		U
		Benzo(k)fluoranthene		11		U
		Chrysene		104		U
		Dibenzo(a, h)anthracene		21		U
		Indeno(1,2,3-cd)pyrene		.31		U
		Acenapthylene		1600		U
		Benzo(g, h, i)perylene		52		U
		Phenanthrene		438		U

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PA1-DUP1

Matrix: Soil 90. % Dry Weight:

Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g

Extract Vol:

1.00 ml

Lab Sample ID: 98-A88637 7/27/98 Date Sampled: 7/29/98 Date Received: Analysis Date: 8/8/98 Analysis Time: 0:34

Sample Identification

Sample QC Group: 1116

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCEN	TRATIO	N F	L-AG
	Naphthalene		1330		U
	Acenapthene		1330		U
	Anthracene		489		U
	Fluoranthene		156		U
	Fluorene		156		U
	Pyrene				
	Benzo(a)anthracene	• •			
		• •			
	Benzo(a)pyrene	• •			
	Benzo(b)fluoranthene	• •			
	Benzo(k)fluoranthene	• •			
	Chrysene				
	Dibenzo(a,h)anthracene		22		U
	Indeno(1,2,3-cd)pyrene		33		U
	Acenapthylene		1710		U
	Benzo(g,h,i)perylene		56		U
	Phenanthrene		467		U



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Sample Identification

PA1-SB8-3

Matrix: Soil % Dry Weight: 98.

Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SW8310 108315 Delivery Group:

Instrument:

Grams Extracted: 30.0 g Extract Vol:

1.00 ml

Lab Sample ID: 98-A88638 Date Sampled: 7/28/98 7/29/98 Date Received: 8/8/98 Analysis Date: Analysis Time: 1:11 Sample QC Group: 1116

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCEN	TRATIO	ON F	LAG
	Naphthalene:		1220		U
	Acenapthene		1220		U
	Anthracene		449		U
	Fluoranthene		143		U
	Fluorene		143		U
	Pyrene		184		U
	Benzo(a)anthracene		9.2		U
	Benzo(a)pyrene		15		U
	Benzo(b)fluoranthene		12		
	Benzo(k)fluoranthene		11		
	Chrysene		102		
	Dibenzo(a, h)anthracene		20		
	Indeno(1,2,3-cd)pyrene		31		
	Acenapthylene		1570		
	Benzo(g,h,i)perylene		51		
	Phenanthrene		429		
			TC/		w

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PA1-SB9-3

Matrix: Soil 96. % Dry Weight:

Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SW8310 108315 Delivery Group:

Instrument:

Grams Extracted: 30.0 g 1.00 ml

Extract Vol:

Lab Sample ID: 98-A88639 Date Sampled: 7/28/98 7/29/98 Date Received: Analysis Date: 8/ 8/98

Sample Identification

Analysis Time: 1:48 Sample QC Group: 1116

Extraction Date: 8/ 3/98

_			The second secon	-
	CAS NUMBER	ANALYTE	CONCENTRATION FLA	4G
		Naphthalene	1250 l	j
		Acenapthene	1250 U	1
		Anthracene		3
		Fluoranthene		1
		Fluorene		j
		Pyrene		,
		Benzo(a)anthracene		,
		Benzo(a)pyrene		,
		Benzo(b)fluoranthene		j
		Benzo(k)fluoranthene		,
		Chrysene		3
		Dibenzo(a, h)anthracene		
		Indeno(1, 2, 3-cd)pyrene		J
		Acenapthylene		j
		Benzo(g,h,i)perylene		
		Phenanthrene		
				•

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Sample Identification

PA1-SB10-3

Matrix: Soil

% Dry Weight: 98. Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g - Extract Vol: 1.00 ml

Lab Sample ID: 98-A88640
Date Sampled: 7/28/98
Date Received: 7/29/98
Analysis Date: 8/ 8/98
Analysis Time: 3:01
Sample QC Group: 1116

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCENT	RATION	FLAG
	Naphthalene	12	220	. U
	Acenapthene		220	. U
	Anthracene			. U
	Fluoranthene		43	. U
	Fluorene		43	. U
	Pyrene		34	. U
	Benzo(a)anthracene		2	. U
	Benzo(a)pyrene		5	. U
	Benzo(b)fluoranthene		2	. U
	Benzo(k)fluoranthene	1:	1	. U
	Chrysene		02	. U
	Dibenzo(a, h)anthracene			. U
	Indeno(1,2,3-cd)pyrene			. U
	Acenapthylene		570	. U
	Benzo(g, h, i)perylene			. U
	Phenanthrene		29	

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Sample Identification

PA1-SB11-3

Matrix: Soil % Dry Weight: 98.

Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SWB310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g Extract Vol: 1.00 ml Lab Sample ID: 98-A88641
Date Sampled: 7/28/98
Date Received: 7/29/98
Analysis Date: 8/ 8/98
Analysis Time: 3:38
Sample GC Group: 1116

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCE	NTRATI	DN	FLAG
	Naphthalene		1220		. U
	Acenapthene		1220		. U
	Anthracene		449		. U
	Fluoranthene		143		. U
	Fluorene		143		. U
	Pyrene		184		. U
	Benzo(a)anthracene		9.2		. U
	Benzo(a)pyrene		15		. U
	Benzo(b)fluoranthene		12		. U
	Benzo(k)fluoranthene		11		. U
	Chrysene		102		. U
	Dibenzo(a, h)anthracene		20		. U
	Indeno(1,2,3-cd)pyrene		31		. U
	Acenapthylene		1570		. U
	Benzo(g, h, i)perylene		51		. U
	Phenanthrene		429		. U

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Sample Identification

PA1-SB12-3

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g Extract Vol: 1.00 ml Lab Sample ID: 98-A88642
Date Sampled: 7/28/98
Date Received: 7/29/98
Analysis Date: 8/ 8/98
Analysis Time: 4:15
Sample QC Group: 1116

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCEN	TRATIO	ON F	LAG
	Naphthalene		1250		U
	Acenapthene		1250		U
	Anthracene		458		U
	Fluoranthene		146		U
	Fluorene		146		U
	Pyrene		188		U
	Benzo(a)anthracene		9.4		U
	Benzo(a)pyrene		5		J
	Benzo(b)fluoranthene		7		J
	Benzo(k)fluoranthene		11		U
	Chrysene		104		
	Dibenzo(a, h)anthracene		21		
	Indeno(1,2,3-cd)pyrene		10		
	Acenapthylene		1600		
	Benzo(g, h, i)perylene		16		_
	Phenanthrene		438		

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PA1-SB13-3

Matrix: Soil 97. % Dry Weight: Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8310 108315 Delivery Group:

Instrument:

Grams Extracted: 30.0 g

Extract Vol:

1.00 ml

Lab Sample ID: 98-A88643 Date Sampled: 7/28/98 7/29/98 Date Received: 8/8/98 Analysis Date: Analysis Time: 4: 52 Sample QC Group: 1116

Sample Identification

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCENTRATION	N FLAG
	Naphthalene	1240 .	U
	Acenapthene	1240 .	U
	Anthracene	454 .	U
	Fluoranthene	144 .	U
	Fluorene	144 .	U
	Pyrene	186 .	U
	Benzo(a)anthracene		U
	Benzo(a)pyrene	15 .	U
	Benzo(b)fluoranthene		U
	Benzo(k)fluoranthene		U
	Chrysene		U
	Dibenzo(a,h)anthracene		Ū
	Indeno(1,2,3-cd)pyrene		U
	Acenapthylene	*	Ū
			Ü
	Benzo(g, h, i)perylene		5.1
	rnenanthrene	4 00 .	



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PA1-SB14-3

Matrix: Soil

% Dry Weight: 91. Units: ug/kg dry weight

Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g Extract Vol: 1.00 ml Lab Sample ID: 98-A88644
Date Sampled: 7/28/98
Date Received: 7/29/98
Analysis Date: 8/8/98
Analysis Time: 5:29
Sample QC Group: 1116

Sample Identification

Extraction Date: 8/ 3/98

	•		
CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
	Naphthalene	1320 .	U
	Acenapthene		U
	Anthracene		U
	Fluoranthene		U
• • • • • • • • • • • •	Fluorene	4	U
	Pyrene		U
	Benzo(a)anthracene		U
	Benzo(a)pyrene		U
	Benzo(b)fluoranthene		Ū
	Benzo(k)fluoranthene	4	U
		· · · · · · · · · · · · · · · · · · ·	Ū
	Chrysene		Ū
			Ü
	Indeno(1,2,3-cd)pyrene		Ü
	Acenapthylene		U
	Benzo(g, h, i)perylene	· · ·	U
	Phenanthrene	402 .	0

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Matrix: Soil

94. % Dry Weight:

Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SW8310 108315

Delivery Group:

Instrument:

Grams Extracted: 30.0 g

1.00 ml Extract Vol:

Sample Identification

PA1-SB15-3

Lab Sample ID: 98-A88645

7/28/98 Date Sampled: 7/29/98 Date Received:

Analysis Date: 8/8/98 6:06

Analysis Time: Sample QC Group: 1116

8/ 3/98 Extraction Date:

CAS NUMBER	ANALYTE	CONCEN	TRATIO	ON F	LAG
	Naphthalene		1280 1280		
	Anthracene		468		U
	Fluoranthene		149 149		U
	Pyrene		191 4. 7		
	Benzo(a)pyrene Benzo(b)fluoranthene		9 4		
	Benzo(k)fluoranthene		12 106		
	Chrysene		21		U
	Indeno(1,2,3-cd)pyrene Acenapthylene		10 1640		U
	Benzo(g, h, i)perylene Phenanthrene		18 447		

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PA1-DUP2

Matrix: Soil % Dry Weight: 94.

Units: ug/kg dry weight Dilution Factor: 1.

Analysis Method: SW8310 Delivery Group: 108315

Instrument:

Grams Extracted: 30.0 g Extract Vol: 1.00 ml Lab Sample ID: 98-A88646 Date Sampled: 7/28/98 Date Received: 7/29/98 Analysis Date: 8/ 8/98 Analysis Time: 6:42 Sample QC Group: 1116

Sample Identification

Extraction Date: 8/ 3/98

CAS NUMBER	ANALYTE	CONCE	TRATIO	I NC	LAG
	Naphthalene		1280		U
	Acenapthene		1280		U
	Anthracene		468		U
	Fluoranthene		149		U
	Fluorene		149		U
	Pyrene		191		U
	Benzo(a)anthracene		4. 6		J
	Benzo(a)pyrene		7		J
	Benzo(b)fluoranthene		6		J
	Benzo(k)fluoranthene		12		U
	Chrysene		106		
	Dibenzo(a, h)anthracene		21		
	Indeno(1, 2, 3-cd)pyrene		10	•	_
	Acenapthylene		1640		
	Benzo(g, h, i)perylene		18		
	Phenanthrene		447		



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FLA PRO RESULTS SUMMARY

FORM I

LAB ID	SAMPLE ID	FLA PRO FLAG CONCENTRATION
98-A88630 98-A88631 98-A88632 98-A88633 98-A88634 98-A88635 98-A88636 98-A88637 98-A88638 98-A88639 98-A88640 98-A88641 98-A88642 98-A88642 98-A88643 98-A88644 98-A88645 98-A88645	PAI-SBI-3 PAI-SB2-3 PAI-SB3-3 PAI-SB4-3 PAI-SB5-3 PAI-SB6-3 PAI-SB7-3 PAI-DUP-1 PAI-SB8-3 PAI-SB10-3 PAI-SB11-3 PAI-SB12-3 PAI-SB13-3 PAI-SB13-3 PAI-SB14-3 PAI-SB15-3 PAI-DUP-2	10.4 U 10.3 U 10.4 U 10.6 U 10.8 U 10.4 U 11.1 U 10.2 U 10.4 U 10.2 U 10.2 U 10.2 U 10.2 U 10.3 U 10.4 U 10.3 U 10.3 U 10.6 U 10.6 U
		•

SAMPLE CALCULATION: SAMPLE PAI-SB15-3

Result from raw data = 705 ug/ml Dilution = 10 x Extract volume = 2 ml Volume extracted = 25 g Dry weight = 94%

 $\frac{705 \text{ ug/ml} * 10(DF) * 2.0 \text{ (ext vol)}}{25 \text{ g}} = 564 \text{ mg/kg wet wght}$

564 mg/kg / 0.94 (dry wght %) = 600 mg/kg dry wght

Walton, Norman

From: Hansen, Jerry E, Mr, HQAFCEE [Jerry.Hansen@HQAFCEE.brooks.af.mil]

Sent: Tuesday, August 08, 2000 10:16 AM

To: 'nwalton@dtic.mil'

Subject: Distribution statement for AFCEE/ERT reports

Norman, This is a followup to our phone call. The eight boxes of reports you received from us are all for unlimited distribution. If you have any questions, you can contact me at DSN 240-4353.